Volume 126 New York, August 4, 1928 *Number* 5

ENGINEERING AND
MINING JOURNAL

A consolidation of "Engineering and Mining Journal" and "Mining and Scientific Press"
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Cable Address: "Machinist, N. Y."
Copyright 1928
By McGraw-Hill Publishing Company, Inc.
Publishers of
Engineering News-Record American Machinist
Power Chemical and Metallurgical Engineering
Coal Age Engineering and Mining Journal
Ingeniería Internacional
Electrical World Electrical Merchandising
Bus Transportation Electric Railway Journal
Construction Methods Radio Retailing
Electrical West
(Published in San Francisco)
American Machinist—European Edition
(Published in London)

The subscription rate in the United States is $6 per annum, including postage. United States possessions, Canada, Mexico, and the countries of Central and South America, $7.50 per annum, including postage. All other countries, $10 per annum, including postage. When a change of address is to be made, the new and the old addresses must be given. Notice must be received at New York at least ten days before the change can be expected to take place.

Published weekly. Entered as second-class matter, June 20, 1879, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

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11,339 Copies Printed This Issue
Total Number of Issues to Date, 3,242

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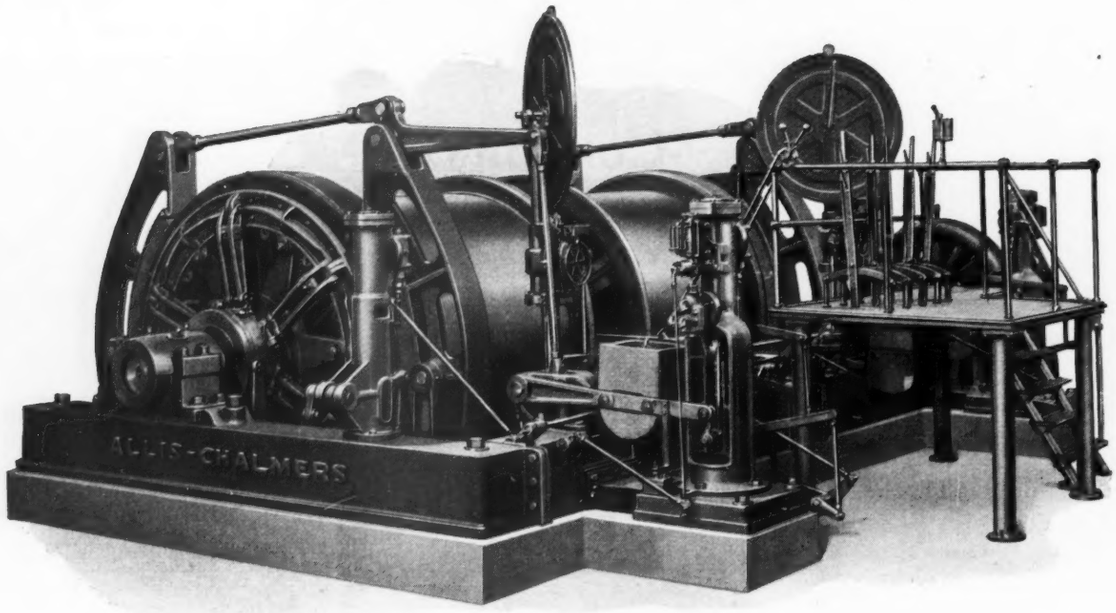

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ENGINEERING AND
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McGraw-Hill Publishing Company, Inc.
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A. W. ALLEN,
Editor

VOLUME 126 — *New York, August 4, 1928* — NUMBER 5

Applying Engineering Method in National Affairs

APPRECIATION of the value of the engineering mind in the conduct of business and in the handling of national and international affairs is growing apace. A recent issue of the *New Republic* contained two editorial articles on Mr. Hoover, in addition to lengthy comment on the Republican candidate by its Washington correspondent. This periodical is by no means pro-Hoover, nor is it anti-Smith. Its editorial comment is invariably reflective of deep analysis and indicative of careful observation, with "an ear to the ground" in anticipation of future tendencies. It is of interest, therefore, to quote from it to demonstrate how great has been the national appreciation of Mr. Hoover's work and of the engineering mind in government.

Mr. Hoover believes, we read, in "scientific method and its application to the pursuit of human ends." Commenting on this "emphasis on method," the writer maintains that "It is very well to believe in business and to subordinate government to it, but those who put their trust in scientific method are obliged to question whether rule-of-thumb business is capable of achieving its alleged objects." In consequence, "He will have to tackle the problem of applying his engineering methods to the more flimsy part of the economic structure."

This is perfectly true, and the outcome must be expected, but "He brings an active and a realistic intelligence to the examination of concrete problems, and his personal instincts demand of him decisions rather than pretensions and evasive discourse. His mind is occupied with the study of processes and the effort to improve them, rather than with the elaboration of principles and the justification of conclusions."

One rubs one's eyes with something akin to amazement on realizing that scientific and common-sense method may be injected into national affairs. Is it really possible? "In the past," states the writer of another article in the same *New Republic*, "the training and experience of an engineer would, except in very rare instances, practically disqualify a man for high and particularly for the highest political position." But "Mr. Hoover is an engineer who is also a business man. The methods which he represents as a business man are determined by training and experience as an engineer; and the purposes which inform his activities as an engineer are determined by his outlook as a business man. As a combination of engineer and business man he is a startling apparition in American politics."

Naturally, however, the introduction of engineering method into affairs of state has caused misapprehension and suspicion in some quarters. "It is so new and untried in public office of any kind, so completely dissociated from any thought of the presidency," avers the Washington correspondent of the journal above quoted. It fills certain groups with suspicion. "It means construction, and they do not want to be constructive. . . . All they want to do is to hold what they have and get a little more in the same way they got that." But, as Mr. Herbert Croly points out, the Secretary has inspired confidence. "The trade papers were all enthusiastically for him, and so were the Chambers of Commerce. The effectiveness of their support proved the existence of a new power in American politics. They recognize in him the practical, non-political point of view of a business man, combined with the methods of a technician and with the experience of managing large human as well as large business enterprises."

No apology is needed for quoting so extensively from a non-technical review when the comments made are so sane and so pertinent. It is in Mr. Hoover's non-political point of view, and because of his eminence as an engineer, an organizer and a humanitarian, that *Engineering and Mining Journal* looks forward to his success at the polls in November; and, with every confidence, to the outcome of the greatest administrative experiment in American history.

A New Metal Trade Association Is Announced

AN ASSOCIATION of lead producers and consumers has been rumored for some time; provisional plans were officially announced last week, and the organization is likely to be functioning before the end of the year. Without doubt, its formation has been inspired by the success of similar organizations by the copper and zinc industries. The American Zinc Institute and the Copper and Brass Research Association have several years of successful effort behind them; the Copper Institute is a product of the last year, but its value has already been demonstrated in giving the producers fuller information as to the current state of the market, thereby making it possible for them to manage the economics of their industry more intelligently.

Especially noteworthy is the announced intention of the new lead association to develop the community of interest between both the producers and consumers of lead; this is in line with the aims of the first two organizations mentioned above, but the Copper Institute is for producers only. Lead miners, smelters, and manufacturers have much in common, and the more inclusive nature of this organization would seem wise as no other association would duplicate its effort. Whatever business development affects the even flow of lead to the manufacturer has a distinct bearing on the conduct and

prosperity of his enterprise, and vice versa, if the outlet of manufactured lead is disturbed, the miner should know about it and govern himself accordingly as soon as possible. Thus will stability be secured, a stability desired alike by all the factors in the industry.

Numerous large and influential corporations are heavily interested in all of the various links in the chain of lead production and consumption. Anaconda, American Smelting & Refining, Eagle-Picher, Bunker Hill & Sullivan, and National Lead are examples of companies that look on lead from more than one point of view. But it is not alone to these large corporations that the new institute must look for support. It should have a service that will help the smaller companies, whether producers or consumers, as well, and if the movement is supported by anything like 100 per cent of the industry, as it deserves to be, the return to the member companies will be proportionately great. Such has been the experience of properly managed trade associations in other fields.

The latest movement is well sponsored and promises to have excellent management. It has a big job ahead first to find out what data will be most useful to its members, and then accurately to report it, but its field promises to extend far beyond that of a mere statistical association. The new association deserves, and will no doubt have, the most sympathetic support by all branches of the industry.

The Storage Battery and Efficient Use of Electric Energy

ONE of the reasons for a neglect to utilize electric power, and so to take advantage of a valuable aid to cost reduction, lies in a general lack of knowledge as to how it may be made available. Some mining companies purchase power from a central station; others manufacture their own. Both private and public utility stations are confronted with the emergency-load problem, yet rarely does the smaller installation comprise provision for the accumulation of power in storage batteries, proved so essential to the efficient and economical operation of units owned by companies that specialize in the production and sale of current.

Irregular power load is a characteristic of requirements in mining work; and, even if the company buys its power, it can usually get better rates if provision is made for storage, in batteries, for peak-load emergency purposes, thus equalizing the inflow of power and avoiding penalties that result if peak demand, corresponding to a minimum cost rate, is exceeded. The smallest power plants, used mostly for domestic purposes in outlying districts, have their storage batteries, which perform a useful function in providing current in emergencies and in balancing the load. Especially to be noted is the flexibility to be secured by the use of storage batteries in connection with relatively small gasoline-engine-driven generators, with the possibility of storing power during light load periods. The uses for storage batteries have increased enormously in recent years—to accumulate electric power and to make it available on the instant of demand, and to correlate an irregular requirement with a fixed supply.

The value of the storage battery has been demonstrated in what was perhaps the greatest development in the history of the automobile—for starting and lighting purposes. It also performs useful and efficient service in light- and medium-duty haulage in the transportation field. The successful development by the New York Central Railroad of a large locomotive, with ample reserve power for frequent peak starting loads, is the result of the recognition of the value of the storage battery as an accumulator of current. The electrification of locomotives at Chuquicamata connotes a growing recognition of the value of the storage battery in surface mining work; and the interest being taken in the self-contained storage-battery trammer presages further labor and cost reductions in underground metal mines.

Proper Care of Batteries

VAST SUMS have been spent in research recently in the development of a storage battery that will meet the severe service conditions imposed, and provide a steady supply of power and, in consequence, a uniform motor speed. Attention has been paid to the minutest details of construction and to hidden refinements in manufacture; and the ultimate product is a credit to American ingenuity and perseverance. No possibility exists, however, of producing a unit in this class that is entirely foolproof and capable of steady service for long periods if all instructions and recommendations in regard to charging and discharging, maintenance, and cleanliness are ignored. The trouble has been due in large measure to an over-dependence on the periodic visits of an inspector, sent out by the manufacturer of the battery, who can do little more than emphasize the need for the observance of those simple rules and precautions that should be enforced by the manager or superintendent.

Electric-storage batteries, if operated with a care and attention that costs much less than negligence, often may prove a valuable aid in speeding production, reducing costs, and saving labor. Their control, however, demands also an appreciation of the principles under which they function; and it should be the duty of all in charge of the maintenance of such power equipment to subscribe to this contention. A manager seeking lower costs would do well to insist on the observance of those recommendations that storage-battery specialists advise. Care and cleanliness are the primary essentials to good performance. With these established, a technical interest in the equipment usually follows, as the greatest aid to company success and to the advancement of the individual operator.

Buying Something Made of Lead

ONE OTHER ASPECT of the situation deserves mention, as well. Lead and lead compounds are used extensively in the construction of high-grade storage batteries. It is probable that about one-fifth of the lead produced in the United States is used thus. To help the metal-mining industry as a whole should be the aim of each individual group. Prosperity, like depression, is infectious. The slogan "Buy something made of copper" stimulated interest in that metal and increased general consumption. A similar campaign in regard to lead would promise less, although a vogue for pewter might be encouraged. Few mining companies, however, are not interested in making electric power more easily available in mine, mill, and smelter, and in possible economies by the displacement of hand labor. A good slogan might well be of advantage, such as the following: "Buy something made of Lead—an efficient storage battery."

Disciplinary Action Among Professional Engineers

A NOTICE that was sent recently to the corporate members of the American Society of Civil Engineers contained the following significant statement:

"Notice is hereby given, pursuant to the requirements of the Constitution, that information having come to the notice of the Board of Directors which in its opinion warranted action concerning the expulsion of —— —— ——, Assoc. M. Am. Soc. C.E., from membership in the American Society of Civil Engineers, in the manner prescribed by Article III, Section 2, of the Constitution, and he having been advised of charges against him and reply having been received from him, the matter came on for determination before the Board of Directors at its meeting held in Washington, D. C., and on the 23rd day of April, 1928, action was duly taken by the Board of Directors expelling for cause said —— —— —— from membership in the American Society of Civil Engineers. GEORGE T. SEABURY, Secretary.

This action was evidently taken as a result of a fixed policy of the Society to preserve its good name, maintain the high standing of the profession of civil engineering in the United States, and protect the public. Despite the occasional need for a similar disciplinary action in the profession of mining engineering in this country, it is difficult to recall an instance in recent years when any serious rebuke has been administered, leading to a suspension of privileges that are open to and taken advantage of by qualified mining engineers of good moral standing among their fellows and in the eyes of the public—privileges that should be enjoyed only so long as the unwritten laws of professional ethics and high public service are observed.

An Opportunity for a Fine Holiday in September

BARRING the remote (we are assured) possibility that Nature may upset things by injecting a fortnight of bad weather, members of the American Institute of Mining and Metallurgical Engineers and their friends who take the Newfoundland-Nova Scotia tour in September should have one of the most enjoyable holidays of their lives. They will have opportunity to visit an important salt mine, several old gold mines, the world-famous submarine coal mines, the steel mills at Sydney, and the Buchans property, where the American Smelting & Refining Company is preparing to start the exploitation of a remarkable deposit of lead-zinc-copper ore.

But that is only one phase of the trip—and probably the least: it is an excuse for going, if any be needed. The best reasons for going are the delightful ocean voyage, the gorgeous natural scenery, the historic associations of various localities to be visited, and the pleasant and congenial companionship that is assured. Accommodations will be the best obtainable; the trip can be made with every comfort, even for the ladies who will be along, and the schedule is leisurely enough, so that no one should be worn out. A fault of such excursions sometimes is that the pace is too hot. Hunters and fishermen are promised opportunity to partake of some of the finest sport in the world.

Officials of the Institute urge that members who have not already done so make their reservations promptly, so that necessary arrangements can be made to the best advantage. The steamship on which the party will travel will leave Boston on Sept. 1.

Rehabilitation of Hydraulic Mining in California

GOVERNMENT engineers of the California Débris Commission state in their last report to the Senate Commerce Committee that "From an engineering viewpoint the Commission is unable to see any material advantage to the United States due to the rehabilitation of the hydraulic-mining industry."

If it be agreed that the Commission's perception is no better than its mode of expression, the conclusion should occasion no surprise. Nevertheless, *Engineering and Mining Journal* takes the opportunity to dissent. Any increase in industrial employment is of material advantage to the United States. Increase in the domestic production of gold is also of advantage. The use of more materials in construction will help the producers of those materials. The wider use of mechanical appliances affords new markets for manufacturers' products.

Rehabilitation of hydraulic mining in California will mean the development and improvement of technical practice, which will be of general value. Money will be spent for equipment, labor, and materials, and this will benefit near-by and distant communities. There is promise, therefore, of material advantage to the United States if large-scale hydraulic mining be resumed. Furthermore, the addition of millions of new wealth would ultimately be of benefit to all the world.

The Sawyer decision stopped hydraulic mining and resulted in an almost total loss to the operators. The Caminetti Act was a belated attempt to undo the injustice to the miner. By it, the right to mine was given, but exacting conditions were imposed. These conditions have been applied by the California Débris Commission. In addition, the Commission was given the power to build dams as and when appropriations may be made by law; for the retention of débris by such dams the miner is required to pay a tax of 3 per cent of the gross proceeds of his mine. No such dams have been built. Appropriations were made by federal and state governments for débris-restraining barriers on the Yuba River, but these were provided for the protection of the channels at Marysville.

Private capital is permitted to undertake the erection of dams, and can thereafter operate hydraulic mines; but except in relatively few instances no advantage has been taken of the option, because of the uncertainty of the situation. Even though miners complied with all the requirements of the Commission, the hazard of interference to operations by injunction would still remain.

The multiplicity of interests concerned involves a complication, and the only solution of the problem would seem to be the erection of débris-restraining dams at government expense. Obvious objections to this proposal will be raised, but advantage is seen in the federal control of a difficult situation. If the dams are erected at public expense, under the charge of the Débris Commission, such expense may be recouped, in part at least, by the mining and other industries benefited. The rights of all concerned would then be safeguarded.

Phosphate Mining in Florida

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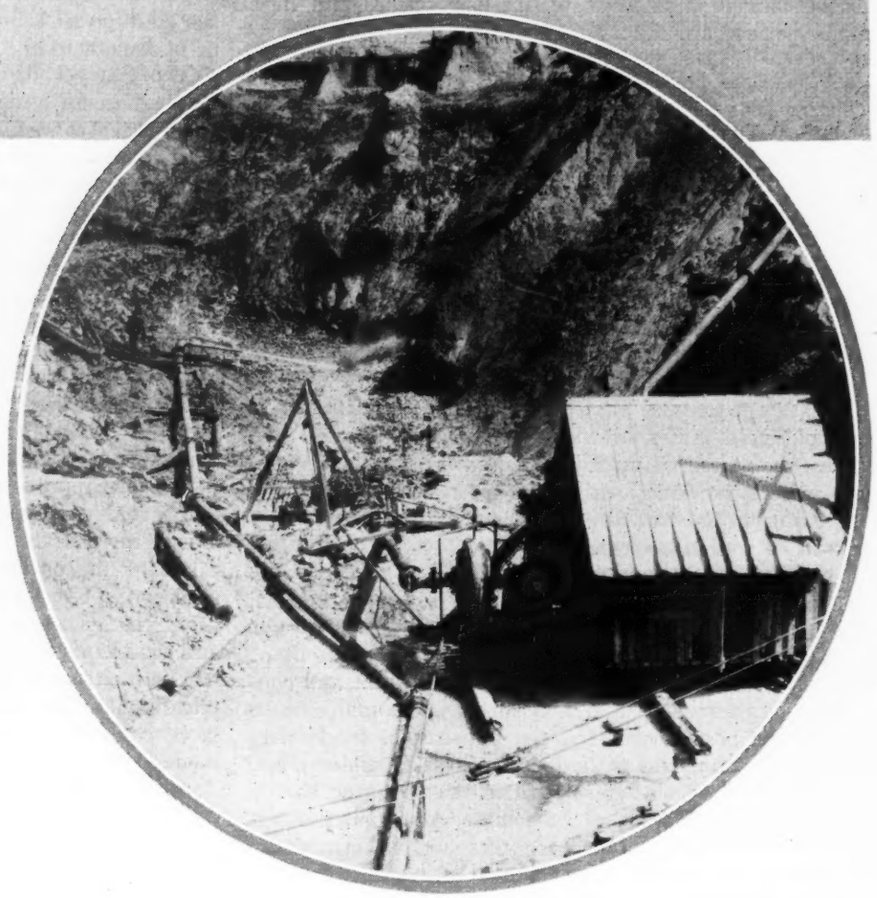


Florida is not a great mining state, but the production of phosphate is an important industry there. Near Dunellen is the dredge shown above, which, by removal of the phosphate, has created an artificial lake. The dredge can dig 25 ft. below the water level. To the right is shown one of the hydraulic operations

Chalette, Cree Indian, Discoverer of the Sheritt-Gordon, with Three of His Sons

Pre-Cambrian Misconceptions

Canadian Mineral Resources, Admittedly Large, Grossly Exaggerated in Propaganda

By C. M. CAMPBELL
Mining Engineer, O'Okiep, Namaqualand

THE question of the life of the world's mineral resources is a frequent source of discussion among engineers. Increase in consumption, it is pointed out, is now a geometrical ratio, and though, in general, supply is at present keeping pace with demand, this condition is due mainly to more rapid depletion of older developed deposits, and not to the discovery of new ore. Sooner or later the supply will be exhausted. For some years astounding statements of the most positive nature, in regard to mineral wealth in the Canadian Pre-Cambrian, have been issued by leading eastern Canadian engineers and influential Canadian journals. Apparently, all thought of the exhaustion of the supply of copper, lead, zinc, tin, and other metals in the not far distant future is foolish: the Pre-Cambrian is in a position to supply all shortages for centuries. An investigation into the merits of these claims is therefore important.

The Pre-Cambrian, as shown on the map, divides Canada into two sections; and this dividing line differs from the geometrical one in that it has a breadth, between Ottawa and Winnipeg, of over 1,000 miles. This section hitherto has been variously referred to as "the dead heart of Canada," "a rock-bound waste," or some similarly unattractive name. It has natural resources other than mineral, and they are not inconsiderable, but on the whole it has not been self-supporting. The discovery, more than 40 years ago, of the Sudbury deposits, followed later by the spectacular rise of Cobalt and Porcupine, gave birth to the hope that further discoveries would be made, not only because they would add wealth to the Dominion, but because they would justify a population that would more firmly unite the East and the West.

On the occasion of the accession of Mr. Mackenzie King to the Premiership of Canada in 1922, the president of the Canadian Institute of Mining and Metallurgy for that year, in a message of congratulations, stated, on behalf of the Institute, that "inconceivable wealth in minerals" in Canada was then a "fact," and that mining would be "Canada's greatest industry of the future." It was later stated that this announcement "was not a carelessly worded exaggeration sent on the spur of the moment, but was based on carefully gathered data and was worded to convey the exact meaning intended."

In Canada the term "inexhaustible storehouse" has been stereotyped and is found in all printshops in the Dominion: the Pre-Cambrian is "the mother lode of the world." The *Financial Post,* the leading financial paper in Canada, said editorially on Aug. 12, 1927:

"Practically every inch of that 'dead heart of Canada' is laden with precious minerals—with gold, silver, copper, even with iron, nickel, lead, and zinc. Practically

every acre of that territory will some day be pouring forth its rich flow of wealth for Canada."

The accompanying sketch widely circulated, is a copy of the conventional map of the Pre-Cambrian. This area, about 2,000,000 square miles, is shown as a spotted shield with the legend, "Sudbury," "Cobalt," "Porcupine," appropriately placed. Two small sections, aggregating 3 per cent of the total area, invaded the United States. These have produced the Minnesota iron, Michigan copper, and New York iron deposits, the outstanding value of which is well known. "The United States has done all this with 3 per cent. What should we hope to do with the remaining 97 per cent?" asks the Canadian engineer. It would appear to be a question of preparatory-school mathematics.

Froods, Hollingers and Nipissings Everywhere?

Unfortunately, this logic is all wrong. The Pre-Cambrian, described by C. V. Corless (*Trans.* C.I.M.M., 1924, p. 199) as "broadly uniform in rock formations and mineralization"—in other words, good prospecting ground anywhere for Froods, Hollingers, and Nipissings—has been wrongly so characterized. Instead of being a uniform formation, or made up of uniform formations, it is an aggregation of vitally different formations: Laurentian, Huronian, Hastings-Grenville, Keweenawan, Temiskaming, with anorthosite, diabase, and other intrusions: laid down or pushed up during a period perhaps as long as the entire Post-Cambrian. Only a few of these, making a very small proportion of the total, have been found to contain payable mineral deposits. The United States is very fortunate in that, when the cards were dealt, it received more than its proportion of trumps.

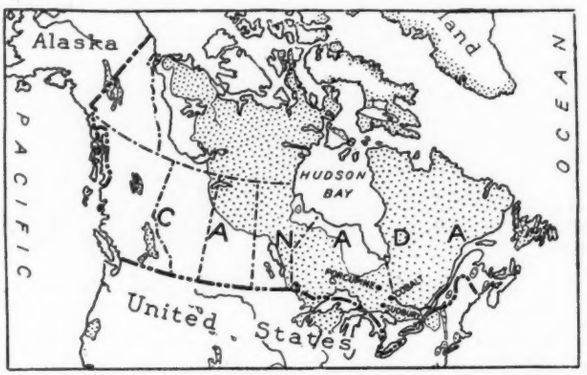
It is interesting to note that the idea of uniformity was also the original conception, with this difference: that in those days, a century ago, it was believed that none of the Pre-Cambrian was any good. The discovery of the Bruce copper mines, on the north shore of Lake Huron, about the middle of the last century, justified the division of the Pre-Cambrian, made by Logan, into Laurentian, a series of granite and granite gneisses, and of negligible mineral value; and Huronian, a series of sedimentary rocks, intruded by volcanics, all greatly altered and containing mineral deposits.

Gold-Bearing Veins in the Laurentian

"Every square mile of Huronian will sooner or later became an object of interest to the prospector." "It is in this series that minerals of value occur." "I know (speaking of a gold district) of no case where gold-bearing veins have been found in the Laurentian." The foregoing are some of the expressions of Dr. Dawson, Director of the Geological Survey, in his report for 1895 and 1896. The search for Huronian areas became one of the objects of the Survey, and when one was found it was recorded with satisfaction.

We read in Dawson's report for 1926, regarding the territory between the upper Nelson River and Cumberland House, "The existence of rocks referable to the Huronian system in this region had been conjectured, from information already gained by Mr. Tyrrell in adjoining areas, and it appeared to be of particular importance to define the area occupied by these rocks and to ascertain their character." Tyrrell therefore descended the Nelson, touched at the Cross Lake area, where a mass of gabbro containing a large quantity of mispickel with some copper pyrites is referred to; crossed over to the north and located the Burntwood River area; then ascended the Grass River and passed through the Huronian area between Herb Lake and Lake Athapapuskow. "This (last) area of Huronian rocks," Tyrrell says, "extending about 75 miles from east to west, and an unknown distance to the north, presents a good field for the prospector, on account of the number and variety of the eruptive masses that break through it, surrounded by zones of highly disturbed and fissured rocks."

It is in this way that these Huronian rocks have been



The Pre-Cambrian Shield is represented by the spotted area

located. Tyrrell's preliminary work pointed the way for the discovery of the Herb Lake deposits, the Mandy, Flin Flon and Sheritt-Gordon. The Burntwood River area is now being prospected, and finds made there will be opened up this season.

Only 5 Per Cent of Manitoba's Pre-Cambrian Area Is Favorable

At this time, after more than 75 years of work by able geologists, the main features of the Pre-Cambrian are pretty well outlined. The area of Laurentian rocks stands roughly at 85 per cent of the total. The map of Manitoba illustrates forcibly the preponderance of the Laurentian. On the surface, the province is 60 per cent Pre-Cambrian, but only 3 per cent Huronian. In other words, only 5 per cent of the Pre-Cambrian in this province is likely mineral-bearing ground. This map also shows that, though the main features have been outlined, small important details may be left out. The Sherritt-Gordon is shown in the Laurentian, whereas it occurs in a series of rocks known as the Kisseynew gneiss, a series of sedimentary gneiss rocks forming an extension of the Huronian rocks to the south, and only recently explored. Other Huronian areas probably will be found. Finds are reported from Reindeer Lake, the southeast shore of which has not been explored. There may be a Huronian area there. Low, when exploring Labrador, found some Huronian drift in the neighborhood of Lake Mistassini and predicted another Huronian area in that district. On the other hand, detailed work has reduced the size of some Huronian areas. In general, however, an increase in the mineral-bearing sections is to be expected with more detailed work.

The Wanipigow Huronian area has produced no profitable mine to date, though much money has been spent there in the last ten years. If, however, the prospector or traveler ascends the next river to the

south, the Manigotagan, paddles for two days, portages 32 times, he finally reaches that part of the central Manitoba district where the Kitchener mine is producing gold. After a few trips in the Pre-Cambrian one gets rid of the delusion of the ubiquitous character of the mineralization.

How the Mandy Was Found

To find a mine in any country is not easy, and the Pre-Cambrian is no exception. A discovery like that of the Mandy is seldom recorded. A certain Jackson, an alleged prospector, seeking information, was told to prospect near by. He paddled over and pegged a claim. Understanding that a discovery post was needed, he put one in. He then kicked away some of the moss and uncovered the outcrop. On the other hand, a widely heralded exploration company started in some years ago to demonstrate the unparalleled richness of the Pre-Cambrian. After five years it not only could not report a single find, but it decided to quit looking. Other companies have made finds; some of them wish they hadn't.

A prominent Montreal geologist in a speech not long ago promised great things for central Labrador: a syndicate has been formed in Toronto to conduct mineral development at Reindeer Lake. There is no need to go so far from home. Not less than a dozen miles from Montreal is a band of Pre-Cambrian, 1,200 miles long and 250 miles broad—300,000 square miles in all—equivalent to the original thirteen states. Montreal men should give it their attention. It has tidewater frontage from Belle Isle to Quebec: it comes to the St. Lawrence at the Thousand Islands at Kingston. From Quebec to Georgian Bay it is crossed by the Quebec-Cochrane branch of the Canadian National, the main lines of the Canadian National and Canadian Pacific between Montreal and the West, the main lines of these railways from Toronto and the West, and by several important branch lines. It is crossed by the Ottawa and the Saguenay and by many smaller rivers. Some of the oldest settlements in Canada are found in the southern half. It contains the Hastings-Grenville series of sparsely mineralized rocks, prospected for over half a century. One would think that this section, close-in as it is, and furnished with all kinds of transportation facilities, would be used as proof of the incomparable richness of the Pre-Cambrian. It is proof of the contrary.

Why Travel 1,200 Miles To Reindeer Lake?

There are in the area just three mining operations of importance: the Tetrault mine, 50 miles west of Quebec, with an annual production of 20,000,000 lb. of zinc and, in addition, some lead, gold, and silver; the Kingdom mine, west of Ottawa, with an annual lead output of 7,000,000 lb.; and the Black Donald mine, near by, the largest graphite mine in the world, but with a production under $200,000. These, with minor operations, make up a total production not exceeding $4,000,000. This is equivalent to about one-third the value of the turnips produced in the adjoining Paleozoic section of Ontario—one-twelfth the size.

Statements are made that the Laurentian contains much undiscovered Huronian; that Algoman granite, a proven source of mineral, is difficult to distinguish from Laurentian. There is some truth in these claims, and this huge, convenient, and, so far, practically barren area, is a good place for their advocates to demonstrate their worth. Why go to central Labrador?

No train goes north from Toronto without its quota of mining men. They reach the Pre-Cambrian 50 miles out. They then cross nearly 200 miles of these rocks before reaching Sudbury or Cobalt. The suggestion is here made that they stop off at Gravenhurst, Scotia Junction, or North Bay, or any of the numerous spots badly in need of a mining industry, and open up a few areas of Algoman or Huronian rocks—there is plenty of room. Why go to Reindeer Lake, 1,000 miles to the north?

Recent History Traced

Between this band and the Manitoba boundary is what has proved to be the most productive section to date. This territory, also with an area of about 300,000 square miles, is mainly Laurentian granite, but scattered throughout and giving it a mottled appearance are about three dozen geologically favorable areas, which aggregate about a third of the total area. The discovery of the Bruce mines in 1846 and Silver Islet in 1868 started mining and gave an impetus to prospecting. Construction of the Canadian Pacific in the early 'eighties brought the Sudbury deposits to light and opened up the first railway right across the Pre-Cambrian. This was followed in the next decade by the mining boom in the territory between Lake Superior and the Lake of the Woods. The first decade of this century was characterized by excessive railway building: Cobalt was discovered and almost reached its zenith. The next decade brought Porcupine and Kirkland Lake into prominence, and the present decade has seen the rise of Rouyn and the significant attack of the Huronian areas north of the most northerly railway in Ontario.

One Per Cent Area: 90 Per Cent Production

There are two outstanding features about this area. The first is that 90 per cent of the entire Pre-Cambrian production comes from that small section, totaling 20,000 square miles, containing Sudbury, Cobalt, Kirkland Lake, Porcupine, and Rouyn. In other words, 1 per cent of the area is responsible for 90 per cent of the production. This is what is meant in Canada by the expression, "broadly uniform in mineralization." The second is that in the area to the west of this rich section and south of the Canadian National main line, covering nearly 100,000 square miles, there is not a solitary successful mine. It is gridironed by over 3,000 costly, deficit-producing miles of railway without a headframe in sight. It contains 30,000 square miles of Huronian rocks; yet, in cases, Huronian rocks appear to be as barren as granites. The hope expressed, now many years ago, that some day there would be a string of silver mines from Silver Islet to Cobalt, has not materialized. Silver Islet is dead; the glory has departed from Cobalt; and Pre-Cambrian silver production is now only about 25 per cent of its best. The Lake of the Woods boom did not produce a profitable operation, nor has the intensive prospecting of recent years, in which this section has shared, had any encouraging result.

"New finds are of almost daily occurrence," says an advertisement. That claim is boom talk. The naked truth in regard to Ontario mining is that no new camp of any real importance has been opened up in fifteen years—not since Kirkland Lake justified its development by starting profitable production. Red Lake may be an exception. When it has demonstrated its right to be classed as the real thing, the time will have arrived to acclaim it.

Prospectors and scouts are rapidly pushing their operations farther north. Not only have they reached Red Lake, in the west, and will likely this year reach Island Lake, shown along the Ontario boundary on the Manitoba map, but they have also reached Lake Chibougamou, near the eastern boundary of this central section.

There still remains to be considered the northern and greater part of the Labrador peninsula, about 350,000 square miles, and the area to the northwest of Manitoba.

A. P. Low explored the Labrador area during the years 1892 to 1895. His report (Canadian Geological Survey, 1895, p. 197L) states, "The Laurentian rocks occupy more than nine-tenths of the peninsula, the remainder being underlain by scattered masses of Huronian and Cambrian." In other words, not more than 10 per cent of this area is favorable prospecting ground. The Huronian areas are those along the East Main River and Lake Chibougamou, which belong to the area just considered. The Cambrian area, now classed as late Pre-Cambrian, contains hundreds of millions of tons of iron ore, mainly low grade. This section runs in a band 400 miles long and 50 miles wide from central Labrador north to Ungava Bay. Similar large tonnages, also of low grade, are found along the west coast of the peninsula, and the hope is expressed that amid so much low-grade ore an appreciable tonnage of good grade eventually will be opened up.

In the area north and west of Manitoba, covering 500,000 square miles, the chief geological work has been done by J. B. Tyrrell. Huronian areas make up only 15,000 square miles in this entire section, the chief one being on Ranken Inlet, on the northwest coast of Hudson Bay. A half dozen other areas are found inland. No economic mineral deposits are known in the Huronian. In this area, however, large exposures of Keweenawan traps and sandstones occur, and chief interest attaches to the Bathurst Inlet and Coppermine River areas, carrying native copper. These areas front on the Arctic Ocean. The conclusion (*E. & M. J.*, Vol. 109, p. 32) in regard to the first is that these deposits "probably form an important reserve of copper ore, but not sufficiently attractive under present conditions of accessibility, transportation, and demand to warrant the large expense necessary to prove and develop the deposits." The same authority states in regard to the Coppermine that, "It seems highly probable that parts of this district contain workable and even rich deposits."

The Coppermine area has been reserved from staking by the Dominion government. It warrants a more detailed report, and with the extension of flying bases farther and farther north a thorough examination by Survey officials will doubtless be made before many years have passed. If, however, any attempt is made to operate within the next fifty years, it will be because the world is badly in need of copper.

In addition to these areas of Keweenawan, there are two other large areas, one touching Doobawnt Lake and the other southeast of Lake Athabasca. The Doobawnt area, according to Tyrrell, has similar rocks to those in the Coppermine. The Athabasca area, as far as has been explored, he says, consists of horizontal red sandstones with a negligible amount of eruptives. Neither shows any native copper, but both, on account of their large size, warrant further exploration. Keweenawan formations cover 100,000 square miles in this northern part.

Herb Lake from the Rex Mine

Government maps use the Cree words solely as place names, thus, Wekusko Lake, Amisk Lake, and so on. In conversation, however, these places are always referred to by their English equivalent; thus, Herb Lake, Beaver Lake, and others.

The foregoing description gives in some detail the chief features of the different parts of the Pre-Cambrian. Certain observations apply, also, to the Pre-Cambrian as a whole.

I once complimented an Indian on his ability as a guide. "Oh," he modestly replied, "that is my business." It is an Indian's business to know the country, and small things seldom escape his attention. Indians guided Samuel Hearne to "the Far-off Copper River," the first mineral discovery in the Pre-Cambrian; and Indians showed Low where the iron deposits of northern Labrador exist: it was an Indian that discovered the Bruce mines, the earliest operation of importance, and an Indian discovered the Sherritt-Gordon, the latest deposit to be opened up. It is significant that the recorded potential deposits in the North are so few.

An Indian's training, however, has not been that of

a prospector, and it is quite possible that he may have overlooked something. He can give startling evidence of this knowledge of woodcraft, but evidence of a valuable mineral deposit may escape his attention. He is learning, however. Trappers also do a considerable amount of prospecting as a side line. Both Sherritt and Madole, connected with the Sherritt-Gordon, were trappers. A trap line may be 100 miles long, and though most of the trapping is done in the winter, a start is made in the fall, so as to get things properly arranged. During this period many an outcrop is examined, and samples are to be found in many of the stores in the North. You may be shown a specimen and told that there is a "whole island of it," this being the Pre-Cambrian equivalent of "a mountain of ore." Present indications are that ore deposits that have been overlooked are going to have a hard time to remain in concealment during the next few years.

Newness Sometimes Overemphasized

The North is not a new country. The Hudson's Bay Company has been operating there for over 250 years. As against this statement it is claimed that the H.B.C. is averse to mining development. Considering instructions given Hearne and such facts as that the company is known to have operated a lead prospect on the east coast of Hudson Bay, this claim is not well founded. Not only has the H.B.C. had scientific men in its employ, but explorers from other companies, free traders, and other unattached explorers, such as Richardson, Rae, and Hanbury, have crossed and recrossed much of this territory. Not only are the observed mineral occurrences remarkable for their scarcity, but reports of Dominion geologists are occasionally met with that do not even devote a chapter to economic minerals.

One of the greatest misconceptions is that commonest of all claims that the Pre-Cambrian has "hardly been scratched." One day, on a Northern lake, I met a party of prospectors. "Well," I said, "how are you getting on?" "Well," they said, "we have done the shore line." The great Pre-Cambrian is a country of low relief. It is largely a land surface with myriads of lakes, or a water surface dotted with islands. Therefore tens of thousands of miles of shore line may be explored. Except in the clay belts, which are few, the rocks usually come down to the water's edge. At low water a ribbon of bare rock is exposed, a few feet wide, washed and polished so thoroughly that an ore deposit shows up like, to use a Kipling expression, "a bar of soap in a coal scuttle." You can follow the bank of a waterway mile after mile, in a motor canoe, with a section of the rock always in sight except now and then when a low spot is met with and reeds block the view. You can often get out of the canoe and walk for miles over rock that is either bare or covered with a thin mantle of earth or moss. Similar conditions exist in the lake areas. In the northern part of Lake Athapapuskow there are a thousand rocky islands; in the Lake of the Woods there are ten thousand; and in the Georgian Bay there are thirty thousand. Probably one-half the total shore line can be prospected with the greatest ease.

Pretty Thoroughly Scratched

Instead of being hardly scratched, it is doubtful if there exists anywhere, outside of arid districts where the hills are bare, any area that is so thoroughly scratched as the great mass of the Canadian Pre-Cambrian. It is strange, therefore, that if mineral wealth is so great, more orebodies have not been found. They should surely have left some clew in the huge number of outcrops easily examined.

After 80 years of development, spasmodically for some time, but, beginning about 30 years ago, of a more intensive character, and culminating in the last few years in some of the most thorough prospecting the world has ever seen, the annual mineral production of the Pre-Cambrian is valued at only $60,000,000. Discoveries in recent years and more rapid depletion of the established properties indicate continued increase for some time at least. Silver production, and gold production as far as the Dome is concerned, are the only doubtful items. A production of $100,000,000 in ten years' time would seem to be a conservative estimate.

The "Speed" of Katanga and the Rand

All this indicates a prosperous industry, but it is not a world beater. It is not to be compared with the speed with which Katanga has come to the front, and even the Rand, scheduled soon to take second place, showed twice as large an increase last year in gold production as did Ontario. The State of Oklahoma which, during the early Cobalt boom was on the map as Indian Territory, with no mineral production whatever, now annually produces mineral wealth valued at about nine times that of the Pre-Cambrian. This state, with one-twentieth the area and 20 per cent of the population, produces as much mineral wealth in a year as all Canada, with its Sullivan, its Sudbury, and its Porcupine, its coal and its asbestos, does in two. There are also five other single states each of which has a mineral production greater than that of all Canada.

A New Flin Flon Every Six Weeks

To maintain a production of even $100,000,000 per year means that all the known deposits will have to be worked to their capacity. Allowing $200,000,000 as the gross value of the metals in the Flin Flon—a popular estimate—it means that, to balance depletion, a deposit of this class will have to be opened up every two years. It is doubtful if the equivalent of this is being done. For Canada to equal its agricultural production with its mineral production—a common claim—means the exhaustion of a Flin Flon every six weeks. There is no indication of development at this rate. The claim is absurd. It is frequently stated that the gross value of the metals in the different Ontario Pre-Cambrian deposits amounts to $2,000,000,000. This is equal to the United States mineral production for only four months. When it is realized that our mineral wealth has to last us for all time, a total of this size, or even ten times this size, is small.

It might also be added that the chief metals found in the Pre-Cambrian to date are gold, silver, nickel, copper, lead, and zinc. The present world's consumption of these metals totals $1,420,000,000, or the equivalent of a Flin Flon every seven weeks. A study of the mining news does not indicate that this is being found.

United States mining engineers every now and then come to Canada and tell us that their country has been pretty well prospected and that the chances of finding further large deposits are slim. United States engineers are seeking mines in every likely country in the world. All this has come about in the last 40 years, a fleeting period in the life of a nation.

A Pre-Cambrian Camp

Mosquito bars set up at the right are an essential in any traveling outfit.

Geophysical methods, though extensively tried, have proved up little ore in the Pre-Cambrian. When asked how many deposits he has located, the head of one of the companies operating machines of this kind replied, "None. I have never been placed over any."

To prevent the extinction of game certain types of firearms are prohibited: to prevent the too rapid exhaustion of our mineral wealth it would seem logical to limit the use of geophysical methods. To date, however, these methods have been responsible for very few discoveries. Improvements may change this, but it may also be true that the number of hidden deposits is nothing like as great as is popularly supposed.

A two-column article arguing in favor of illimitable wealth recently appeared in a Canadian journal of merit. It went on to state that huge tonnages of rock running 40c. per ton were available at the Hollinger in addition to ore of the regular grade. Quartz running twice that amount is not uncommon in the North. The article referred to the extremely low costs at the Alaska Juneau and held out the hope that some day this class of ore would be worked. There is a conviction among many mining writers, chiefly those with no operating experience, that "some day" a way will be found to work at a profit deposits containing small fractional percentages of the base metals and such low amounts of gold as referred to above. No concern is therefore shown at the amazing rate at which the world's reserves are being used up. The Alaska Juneau, with its remarkable low-cost production, is one of the chief arguments. The fact that this property pays no dividends and that its neighbor, the Alaska Gastineau, was closed down and dismantled is overlooked. The story of the Mount Morgan is also overlooked.

Total Receipts Less Than Total Expenditures

Probably the lowest operating costs obtained in Canada, though appreciably higher than the Alaska costs, were those obtained in the Boundary district of British Columbia. From the different mines in this district twenty million tons of ore running 1.15 per cent copper and one dollar in gold and silver was extracted during the period 1900 to 1920. Lowest costs, reached about 1913, were 76c. for mining and development, 25c. for transportation over a heavy grade, equivalent to a cent per ton-mile, and $1.23 for smelting and converting. These costs could not, however, be maintained because of rising costs of labor and supplies. It is doubtful if recent advances in mining, milling, and smelting could improve this record appreciably. Also, though these mines paid dividends aggregating over $8,000,000, it is doubtful if the total receipts balanced the total expenditures. Conditions that have prevailed in Alaska and the Boundary seldom prevail elsewhere; nor should the meager profit and even loss be overlooked. Granting that operating costs in general are being reduced, the reduction is slight and there is nothing to indicate the magical reduction necessary if metals are to be produced in the future, at reasonable prices, from material of the grade mentioned. These tonnages of subnormal grade can therefore be left out of Pre-Cambrian assets.

No Lack of Capital

Lack of capital is blamed for the non-development of Canada's mineral reserves. Another misconception. There is not and never has been any serious lack of capital. This is essentially an excuse offered when promised wealth fails to materialize. It has been used so often that it is actually believed by many engineers. Any prospector can usually get his claim examined without undue delay. If the report is favorable, work will be done—at present there is competition as to who will do it. If work is not done, the trouble is not due to lack of capital but to lack of a favorable report.

At the present time a prospect need not have any special merit to have money spent on it. There is a mining boom in Canada. A boom has the same attraction to a Canadian as a spoon has to a jackfish. Notwithstanding the experience of the Rossland boom, the Lake of the Woods boom, and the Cobalt boom, he says again, with enthusiasm, "This boom is different from all the others; there is no hook on this line." Shares in 150 non-producing mining companies are traded in on the Toronto exchange. "Broker's commission totaled

$1,495,424 for the month of November last. This almost equals the gold production for the same period," says a news item. It may be that the brokers get most of the capital, but there is no lack of it.

Such is the much boomed Pre-Cambrian. Of the 2,000,000 square miles, over 1,600,000 has been referred to. The balance is in the Arctic islands. Of the total it is doubtful if more than 15 per cent offers any attraction to the prospector. Large sections of the best ground, of the most likely formations, which have been classed together in this article as Huronian, are unproductive. Either they did not have the necessary structure, or the ore solutions were missing, or, if ideal conditions existed, it too often happened that the resulting ore deposit has been too low in grade to work.

Though the results do not begin to warrant the perfervid language in which reference to the Pre-Cambrian is made, care should be taken not to create the impression that the Pre-Cambrian is unimportant or that future possibilities are negligible. Even 15 per cent of the total is 300,000 square miles, and even when prospected ground is taken out, a large area is left. Production has been considerable, and reserves guarantee increased production for some time. In supplying even large quantities of nickel the Pre-Cambrian has added appreciably to the attractiveness and efficiency of the world. It is a strong point in favor of the Pre-Cambrian that the Sudbury deposits are of a magnitude that places them in the first rank of metal resources.

Mines Generally Located in Early Days

One of the features of mining in Canada is the rule that all the leading mines in a camp have been located in the very early days. This was the situation in Rossland, as it was in the Boundary, notwithstanding heavy development expense to prove the contrary. In eastern Canada it has been the condition in Cobalt; and Porcupine and Kirkland Lake have not proved to be exceptions. Until some years ago it was believed that Sudbury was no exception; that all the ore deposits in that camp had been determined. Evidence given before the Ontario Nickel Commission in 1916 by one of the leading operators stated: "We are confident that very few, if any, wholly new discoveries will be made in the district in future." It is one of the ironies of mining that, though large amounts of Sudbury money have been spent in fruitless efforts in other sections of the Pre-Cambrian, the outstanding discoveries that have been made have been right in the Sudbury district, and have been made by outsiders—rank outsiders in the instance of the Errington. Sudbury operators have as a consolation, however, spectacular discoveries in their own mines.

In 1916 and 1917 the E. J. Longyear Company drilled that area of the contact east of the Garson mine and located what Coleman describes as "one of the largest known orebodies." This deposit exists in a continuous band for 7,500 ft., with a thickness varying from 10 ft. to 120 ft. and a proven depth of 1,020 ft. This reserve is available when required.

Canadians deal generously with outside mining companies. The latest instance is that of the Flin Flon, where royalties have been waived for twenty years, equivalent to the life of the mine, and the Manitoba government has agreed to bear railway deficits for five years. They not only give their raw material away, but help to pay the cost of getting it out of the country. In return for this a clear statement of the mineral blocked out is surely in order. It is not yet demonstrated that the Errington mine owners are not giving this information. The matter has been summed up by an Ontario mining writer as follows: "One hears of what the Bunker Hill & Sullivan people actually think of its Errington mine in terms of a billion or more dollars. As work proceeds, the extent of the orebody and the richness and variety of its mineral content stagger even mining men who have been accustomed to huge deposits. It is said that the Bradley people are certain they have made the mineral find of the last hundred years on this continent, if not of all time."

"Inside of the Cup"

Maybe they have. Considering that "the inside of the cup" is an area 10 miles by 30 miles, and that it is showing up ore of similar value to the margin, there is some reason to believe that future development will produce something out of the ordinary.

A few square miles of ground will sometimes contain an orebody that will supply an appreciable proportion of the world's demands for decades. The untouched Huronian areas, though a very small proportion of the entire Pre-Cambrian, are amply large enough to contain important deposits. They may—or they may not—contain something staggering. Time will tell.

With the completion of the Hudson Bay Railway to Churchill and the branch of this road to the Flin Flon and Sherritt-Gordon; the extension of the Temiskaming & Northern Ontario to James Bay; together with the extension of the Royal Air Force services and commercial flying—all of which are scheduled for the next few years—areas that are now inaccessible will be brought within the range of the prospector and the exploration company. At the rate things move these days examination of the outlying areas, in a fairly intensive manner, is not going to be the work of centuries. Another 25 years and we will have a pretty good idea of the wealth of the Pre-Cambrian. There will then doubtless be a few polls to hear from, but it is unlikely that they will greatly affect the result.

Unless virgin areas are much richer than those already explored (and there is no reason to believe that they are), the Pre-Cambrian cycle will be much the same as that of any other mineral area. That the present prosperity will continue, and even increase, it is not the object of this paper to question. It is, however, believed that the evidence detailed in the foregoing will show the absurdity of the claims of inexhaustible wealth which are being broadcast from responsible sources.

Canadian newspapers some time ago quoted the following paragraph from an address by the head of the department of economics of McGill University:

"The human race," said Dr. Leacock, "for 100 years has been living on its capital. In the midst of wealth it has grown poorer. It is now beginning to find the limits of its boasted power over nature in the exhaustion of nature itself."

It is submitted that there is nothing about the Pre-Cambrian seriously to discredit that conclusion.

NEXT WEEK: Some phases of the outlook for copper will be discussed by A. B. Parsons

Mine Production in Alaska In 1927

MINES in Alaska produced $14,404,000 worth of minerals in 1927, against $17,657,800 in 1926, according to a recent announcement by the U. S. Geological Survey. The total value of the mineral output of the territory since 1880 is $585,374,000.

The following table shows in summary form the mineral output of the territory for 1927 and, for the sake of comparison, the production of the same minerals in 1926:

	1927		1926	
	Quantity	Value	Quantity	Value
Gold, oz.	286,720	$5,927,000	324,450	$6,707,000
Copper, lb.	55,343,000	7,250,000	67,778,000	9,489,000
Silver, oz.	627,800	356,000	690,000	430,500
Coal, short tons	104,300	548,000	87,300	459,000
Tin, metallic, short tons	26.7	34,400	8	10,400
Lead, short tons	1,008	127,000	778	124,400
Miscel. mineral products	.....	162,000	.....	444,500
		$14,404,000		$17,664,800

Of the decrease the most notable was in the quantity and value of the copper produced, but there was also a considerable decrease in the output of gold and in certain of the substances, notably platinum metals, that have been included in the table as miscellaneous mineral products. The decrease in quantity of silver produced reflects in large measure the decrease in copper mining, as much of the silver is recovered from that source. That there was not an even greater decrease is due to the increased production of silver from the silver-lead ores, especially those of the Hyder district of southeastern Alaksa. There was increased production of coal, lead, and tin in 1927; in fact, the quantity of lead was the greatest that has ever been produced in any one year, and the quantity of coal was exceeded in only one year since mining began in the territory, and then by not more than 15,000 tons.

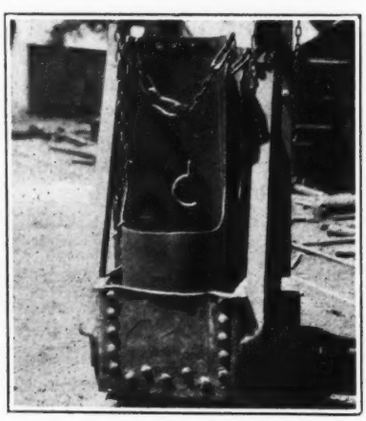
The decrease in production of minerals from Alaska, the U. S. Interior Department believes, is attributable not to permanent waning of the mining industry but to a number of causes, some of which were purely local, others regional, and still others widespread, affecting not only Alaska but the United States as well. One of the widespread causes was the low price at which metals sold during 1927. This not only had the effect of cutting down the value of the product sold, but also had an even greater effect in curbing production. Obviously, during a period of low prices it is only the part of wise management to reduce the output and await more favorable markets. This condition was especially reflected in the output of copper during the year.

Decrease in gold output is, according to this announcement, of course, not attributable to this cause. Instead, it was caused solely by the decrease in production from the gold placers, for the amount of gold recovered from the lodes increased somewhat. The explanation of the decrease in placer-gold production lies largely in the adverse climatic conditions that prevailed at almost all the placer camps throughout the territory during the season. The winter of 1926-27 had a very light snowfall, so that the run-off from the snow when it melted furnished unusually little water. Coupled with this, the early part of the open season was unusually dry, so that at many camps water for mining was not available until August, and by that time many operators had become discouraged and closed up their plants for the season. Even at the large camps the shortage of water forced curtailment of work, so that some of them were operating at only half their normal rate. In many of the districts the season opened so late that seasonal frost lasted even until August. To round out the tale of difficulties, winter set in unusually early in many of the districts, and so further curtailed the amount of mining that could be done.

About equal amounts of gold were derived from lodes and from placers. The bulk of the lode gold still continues to come from mines in southeastern Alaska, and they are increasing rather than diminishing their output. In addition, these mines are already yielding large quantities of silver and lead, and plans are under way for recovering zinc from the ores of the largest mine. The placer gold was produced from a number of camps widely distributed throughout the territory. About 58 per cent of the gold recovered from placer deposits was mined by means of dredges. Twenty-eight dredges were mining in different parts of Alaska, and though mining of this type is generally less affected by adverse climatic conditions, even the largest dredge operators were so hampered in 1927 that they reported a marked falling off in production. Only one new dredge—that of the American Creek Dredging Company in the Hot Springs district of the Yukon—was built and began mining during the year. The large dredging enterprise in the Fairbanks district that has been in course of development for several years reached such a stage that late in the year the material for the first two of the fleet of dredges that are to be built was delivered, and the dredges were set up during the winter of 1927-28. The foregoing facts are taken from a report much more in detail on the mineral industry of Alaska in 1927, which is in preparation for publication by the Geological Survey.

Handling Drill Steel at the North Star

AT THE North Star mine, at Grass Valley, Calif., drill steel is being handled in packets or bundles. A bucket made of a section of pipe with welded bottom and one side prolonged as shown in the accompanying illustration is the unit. The steel is placed in the bucket and secured by a chain at the upper end. A ring in the end of the chain enables the bucket to be lifted and swung into or out of a special car. The special cage car which was formerly in use is retained, the buckets being handled in this car between the sharpening shop and the levels. At the levels where it is necessary to transfer to the inclines a Tugger hoist is installed on a crab and rail above the tracks, so that drill buckets can be lifted and transferred to the material car in the incline shaft. The arrangement effects a saving in time in handling drill steel underground and in the shops.



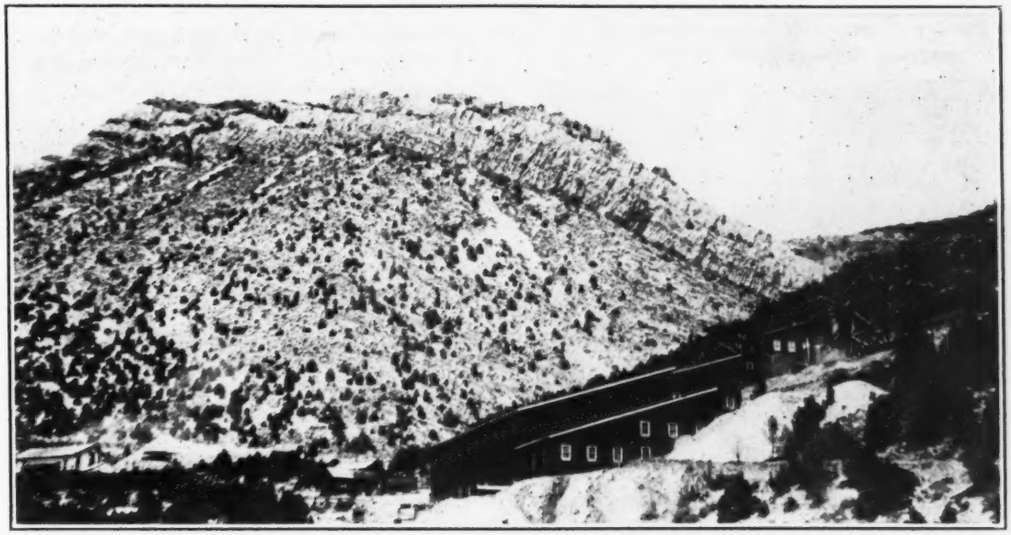
A bucket for handling drill steel

Why Flotation Has Displaced Cyanidation at Cortez

Presence of Sulphide Minerals at Depth Resulted in Change of Mill Practice—Much More Efficient Now

By J. O. GREENAN and E. M. BAGLEY

General Superintendent and Mill Superintendent, Respectively, Consolidated Cortez Silver Mines Company, Cortez, Nevada



The Cortez mill and surrounding country

The power house is at the extreme left, and just to the right is the Arctic Tunnel dump. Note the 300-ft. bed of Eureka quartzite on the horizon; the Pogonip limestone is below and the Lone Mountain limestone above (see article presented in the Sept. 10, 1927, issue of *E.&M.J.*)

THE purpose of this paper is to describe briefly how a change in the character of an ore caused the local application of cyanidation to become expensive and inefficient, how the cyanide plant was converted to a flotation plant at low cost, and to discuss the principal advantages and disadvantages resulting from the change.

Early in 1927, the Consolidated Cortez Silver Mines Company had operated its 125-ton cyanide plant for about four years. The plant followed the usual ball- and tube-mill, counter-current decantation system, using Deister tables to make a small recovery of low-grade concentrate. The ore had been, in general, oxidized, and had consisted largely of low-grade stope fills that had accumulated for about 50 years. However, a sufficient quantity of silver-bearing minerals (mainly galena and tetrahedrite) was present to make a high extraction of silver economically impossible by cyanidation, as indicated by the accompanying tabulation.

In November, 1926, new orebodies were first encountered on the Arctic tunnel level, about 1,700 ft. vertically under surface. These orebodies, although partly oxidized, contained a much larger proportion of sulphide minerals than the ore previously milled. On the upper levels, galena and pyrite were the only sulphides visible, whereas on the Arctic level, galena, tetrahedrite, pyrite, and sphalerite were present in relatively great quantity.

Yearly Metallurgical and Cost Data

	Average Monthly Tonnage	Oz. Silver in Heads	Average Silver Extraction per Cent	Average Cost Milling per Ton	Average Cost Marketing per Ton
1924	2,695	15.79	83.3	$3.67	$0.855
1925	3,342	11.32	79.5	2.97	0.528
1926	3,704	10.14	76.9	2.58	0.445
1927 (Eight months)	2,820	22.20	74.7	3.67	1.40

The increased hardness of the Arctic ore promptly reduced the grinding capacity of the mill, and the in-

creased proportion of sulphides radically reduced the extraction of the silver. Incidentally, the lead and copper content of the ore had reached a point where it was desirable to attempt to recover these minerals also. Grinding capacity was increased by improvements in practice, but extraction decreased in spite of all efforts, and the rate of consumption of cyanide became prohibitive. The extraction of silver declined to a minimum

The Parker cleaner cell in operation, making 800-oz. froth

of 65 per cent; and the milling cost reached a maximum of $4.26 per ton.

Flotation tests had been started almost immediately after discovery of the new orebodies. Testing had been done by three nationally known flotation testing laboratories, by the local staff, and by the staff of a neighboring flotation plant, and in no instance were the results entirely satisfactory. In general, they indicated that a silver recovery of between 75 and 80 per cent might be expected, but that increased recovery might follow careful control and testing after full-scale operations had started. One report suggested that flotation be ignored for the present and that further efforts be made to improve cyanide practice. It was evident that the ore was far from ideal for flotation purposes, on account of the presence of oxidized minerals, among them plumbojarosite and (probably) argentojarosite. It appeared, however, that a milling cost of $1.50 to $1.75 per ton could be expected with flotation, with a somewhat increased marketing cost.

At this time, the arguments in favor of the adoption of flotation were the following:

1. Little ore was left on the upper levels. The new orebodies on the Arctic level were relatively high in silver-bearing sulphide minerals. Underground indications were that most of the future ore would come from below the Arctic level, with the chances in favor of decreased oxidation.

2. With flotation, a saving in milling cost of between $1 and $2 per ton could be expected.

3. Flotation could be expected to give from 10 to 15 per cent increased recovery of the silver, to a maximum of 80 to 85 per cent of the total silver content.

4. Flotation could be expected to recover galena and tetrahedrite and other lead and copper minerals in sufficient quantity to make a profit on these two metals.

5. Flotation would throw less load on the already overloaded power engines.

6. Flotation would eliminate all refinery costs.

7. The sequence of minerals with depth, already fairly well established in this mine,[1] involves the possibility of a radical increase in the copper and zinc content, eliminating cyanidation as even a possible method, and pointing to selective flotation.

8. It seemed possible that flotation might allow coarser grinding, which would permit increased tonnage and lower costs per ton for the entire operation.

The arguments against flotation were:

1. Even the "sulphide ore" from the Arctic level contains a sufficient quantity of oxidized silver-bearing minerals, such as plumbojarosite (hydrated lead-iron sulphate) and argentojarosite, to make a good (90 per cent or over) silver recovery by flotation very improbable.

2. Since the entire output would be in the form of concentrate, which must be hauled 36 miles to the railroad point, hauling alone would greatly increase the cost of marketing, which would be increased further by freight and treatment charges.

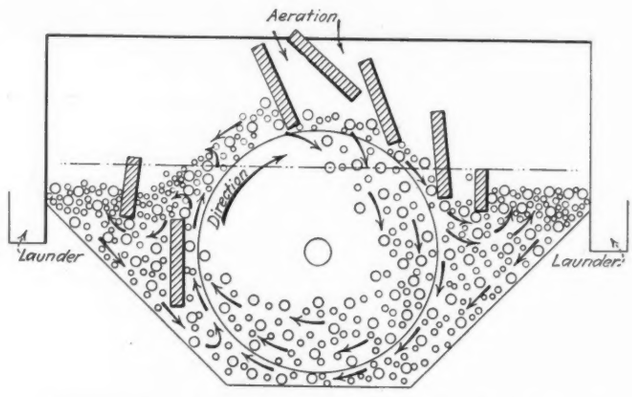
3. Smelters would pay for only 95 per cent of the silver and gold in the concentrate, which would be reflected in increased marketing cost, whereas 100 per cent of the silver and gold in cyanide bullion is paid for by refineries.

4. One of the largest and most competent flotation organizations in the country, after fairly complete tests on a representative sample, recommended the retention of the cyanidation process.

5. Laboratory tests being regarded as undependable, it was uncertain whether full-scale operations would give a silver recovery even as high as the tests indicated. It seemed unlikely that results from the tests would, at best, be improved greatly.

6. No money was available to cover the cost of a flotation installation. In fact, for many months or even years, the operation had been conducted on so small a margin that each current month's bills had been largely paid by the production of the succeeding months. This argument seemed insuperable.

Weighing the arguments, the conclusion was reached



Cross-section of the double-spitz Parker flotation cell

that flotation should be tried. The basic reason for this conclusion was that no 150-ton all-sliming cyanide plant could hope to operate at a profit, with 65 to 70 per cent silver extraction and a milling cost of about $3.50 per ton, except on fairly high-grade ore, and there was no reason to expect that the ore would average over 20 to 25 oz. This seemed to outweigh most of the arguments against flotation. It was hoped that the cost of marketing

[1]See "The Cortez District Rejuvenated," *Engineering and Mining Journal*, Sept. 10, 1927.

could be kept to a minimum by making a high-grade concentrate, thus reducing the tonnage to be shipped.

The strongest argument against flotation was the first cost of the installation. Careful investigation of several of the leading types of flotation machines was made. The conclusion was reached that, for non-selective flotation, there would be little if any difference between them in the metallurgical results on Cortez ore. From our standpoint, then, the important considerations were: (1), low first cost; (2), low power consumption, and (3), low operating cost.

It was planned to install a flotation plant capable of handling 200 tons per 24 hours, as it was thought probable that the grinding capacity could be brought to that point. The company hoped that the machines could be placed inside the mill building already provided, to avoid additional housing cost, so the floor space required by the different types of machines was of importance.

Five different and popular types of machines were considered seriously. One of these, at least, would have required additional housing. Our own estimates of the costs of the various types, installed, were based on manufacturers' figures, and ranged from $5,500 to $16,000. Average power consumption, likewise based on manufacturers' statements, ranged from 12 hp. to 40 hp., and it was evident that the cost of upkeep of certain of the machines would be much greater than that of others.

We finally decided that the Parker cell combined to the highest degree the features that were, from our standpoint, most desirable. The principal argument against the cell was that it was relatively little known, although many Parker cells had been in operation for several years. In order to try it out, one cell was installed, and 110 tons per day was put through it for about three weeks, with an average recovery of 73.31 per cent, the resulting uncleaned concentrate containing 300 to 400 oz. silver. This was considered fairly satisfactory, in view of the heavy overload on the one cell. The entire 200-ton unit, consisting of three roughing cells and one cleaning cell, was then ordered.

In the mill was a small concrete floor, which, under cyanidation, had contained merely the precipitate press, a stove, and a desk. On this floor, which measured 19 ft. 6 in. by 30 ft., the four Parker cells were placed, on timber foundations. The cost of the installation was small, and, as much of the work was done by the regular mill crew, extraordinary expense was kept at a minimum.

From the classifier, which is in closed circuit with the tube mill, pulp is pumped to the first of the three roughing cells, which are in series. Tailing from the third rougher is passed over Deister slime tables, where a 100-oz. concentrate, relatively high in lead, is made. Froth from the first two cells goes to the cleaner, while froth from the third rougher is returned to the classifier, together with cleaner-cell tailing. Froth from the cleaner goes to a Dorr thickener, is dried by an Oliver filter to about 11 per cent moisture, and is then sacked and shipped.

The total cost of the installation complete was $6,326. This included five Parker cells, two Wilfley pumps, pipe, valves, line shaft, belts, lumber, and complementary apparatus and supplies, and the labor of installation. In addition to the above, $2,122 was spent for supervision, flotation testing, and consultants' fees. After the cells were well broken in, power consumption tests were made which showed that each cell consumed, including belt and line-shaft losses, 2.88 hp. when revolving at the normal speed of 60 r.p.m. This figure of 11.52 hp. for the four-cell unit is very low, as it means 1.26 kw.-hr. per ton treated, on a 170-ton basis. The four cells have cost approximately $10 for upkeep in their six months of operation, having required attention only at the packing glands. No blower or other accessory apparatus has been needed.

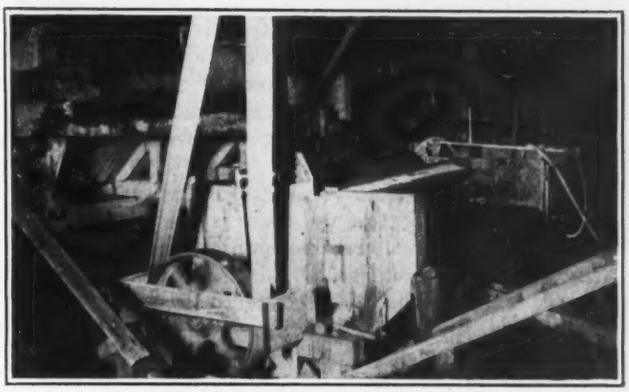
Following is a tabulation of the results of the last five months of cyanidation and tabling, compared with the last five months of flotation:

Comparative Metallurgical Data, Cyaniding vs. Flotation

	Cyaniding with Tabling	Flotation
Average tons milled monthly	2,993	4,296
Heads, average oz. silver per ton	23.3	19.2
Silver recovered, per cent	71.5	84.1
Cost per oz. silver produced:		
Milling	$0.209 a	$0.093
Marketing	0.083	0.095
Total	$0.292	$0.188
Cost per ton milled:		
Milling	$3.48 a	$1.50
Marketing	1.39	1.53
Total	$4.87	$3.03

a includes refining.

Although, in the accompanying tabulation, the low tonnage milled under cyanidation has an adverse effect on all per-ton costs, it is safe to say that, even under equal tonnages, the total difference would be in favor of flotation to the extent of over $1 per ton.



Cleaner flotation cell in the foreground, with Nos. 1, 2, and 3 rougher cells in the background, from left to right

The most interesting point, under flotation, is the relatively great importance of the marketing cost, which actually exceeds the cost of milling. Marketing includes all smelter deductions, treatment charges, freight, and hauling of concentrate. Smelters ordinarily pay for 95 per cent of the silver; in other words, there is a dead loss of 5 per cent of the entire silver output of the mill, which loss is not governed by the grade of the concentrate shipped nor by any other factor in control of the mill. If, for example, 4,000 tons are milled in a given month, and 100,000 oz. recovered, 5,000 oz. would not be paid for by the smelter. This loss of about $2,850 would amount to $0.71 per ton milled. It is important, therefore, to realize, in considering the advisability of replacing cyanidation by flotation, that, although a reduction in the cost of milling is ordinarily to be expected, together with an additional recovery of accessory minerals such as lead and copper, this saving may be offset to a large extent by the increased cost of

marketing. Several methods by which the shipment of concentrate can either be avoided or reduced are being investigated at Cortez.

The Parker cell is a redwood box, normally 8 or 10 ft. long, with a bottom shaped like three sides of a hexagon. In this box is a centrally located rotating member, which consists of a series of 2x4's mounted longitudinally on three cast-iron spiders, and spaced about 1¼ in. apart, thus making up a skeleton cylinder. The spiders are mounted on a shaft, which passes through a gland at each end of the box, the bearings being outside. Clear water is fed to the glands, a bushing around the shaft at the glands further protecting the shaft. Thus the only wearing parts are at the glands and the shaft bearings, aside from abrasion of the 2x4's by impact against the pulp, which is negligible. In six months' continuous operation of four cells, total upkeep material has amounted to 6 lb. of packing and two shaft bushings.

The rotor revolves at 60 r.p.m., and a series of baffles above this rotor encourages thorough aëration. On certain classes of Cortez ore, it has been found advisable to reduce aëration by closing the openings between the baffles. The pulp enters at a corner of the cell, is picked up by the rotor, aërated in passing the baffles, is thrown on the surface of the spitz on one side, and thrown upward toward the surface on the other side, the mineral-bearing froth overflowing the spitz weir. The particles of the pulp probably pass through this cycle many times before reaching the discharge opening at the opposite end of the cell. No difficulty is experienced in building up a good froth or in balancing the overflow on the two sides.

Flotation is responsible for the continuance of profitable operations at Cortez, and there is every probability that the next year will see a considerable increase in its efficiency and economy. If cyanidation had been continued, even with table concentration, it is improbable that operations could have been conducted at a profit. That the flotation plant paid for itself, in lowered milling cost and increased recovery during its first thirty days of operation, is a surprising fact.

E. H. Mohr, of McGill, Nev., acted as consulting metallurgist throughout the entire period of change, and J. B. Parker, of Salt Lake City, acted in a similar capacity after his cells had been chosen for the installation.

Zinc-Dust Precipitation of Copper From Cyanide Solution

IF ZINC DUST be used to precipitate copper, gold, and silver from cyanide solution where the copper content accounts for excessive cyanide loss during the leaching period, the re-use of the cyanide solution will soon result in its becoming fouled with zinc. As the percentage of zinc in the cyanide solution increases, the re-use of these solutions results in corresponding decrease in the extraction of the metals, particularly silver.

Studies conducted by the Rare and Precious Metals Experiment Station of the U. S. Bureau of Mines, at Reno, Nev., show that decreased extraction is noticeable when the solution contains near 0.15 per cent zinc. When it contains 0.36 per cent zinc the cyanide extraction of silver drops from 90 per cent to 75 per cent. This explains why zinc precipitation cannot be satisfactorily used in cyanide practice when there is considerable soluble copper in the ore.

Repairing Leaks in Water Jackets and Pumps

By W. L. Home
Pine Plains, New York

WINTER brings the usual quota of cracked water jackets and pumps, and where quick repairs are needed the ideas in the following will be of assistance, according to a recent issue of *Rock Products*.

For water jackets and centrifugal pumps use a soft patch of lead or copper. If the crack is in a casting of quite irregular shape and not under much pressure, lead is probably best to use. If the crack is easily accessible, somewhat regular and under little pressure, possibly copper would be best.

First locate the extremities of the crack and clean all around it thoroughly. Cut a thin sheet of lead or copper large enough to cover about an inch all around the crack. Hammer this piece of metal over the crack until it exactly conforms to the surface of casting. After this, spot the location for a sufficient number of studs to hold the patch in place. Drill the holes and tap them out the right size for the studs. This part of the work is entirely up to the judgment of the person doing the job. After the stud holes are tapped out, give the surface a generous dose of thick white lead, put the patch in place, and when the studs are tight you will have a neat job that will not leak and will last a long time. A patch of this kind is good on all types of equipment from an automobile to a centrifugal pump.

Leaks from small cracks, where it is possible to get at the inside of the casting and where corrosion is no objection, can be stopped by using sal ammoniac as a corrosive agent. Simply mix up a strong solution of sal ammoniac and fill the casting with the solution until the crack is submerged. Allow this to stand overnight and the leak will seal itself.

New Discoveries in Fighting Fire

RECENT DISCOVERIES indicate that much remains to be learned about fire-extinguishing agents, says a writer in the *Industrial Bulletin* of Arthur D. Little, Inc. It was found not long ago in the laboratories of this company that the insulation of the wires used on telephone switchboards could be flame-proofed by applying a dilute suspension of selenium to the braided wire. Inasmuch as selenium is closely related to sulphur, and is itself combustible, its effectiveness in flame suppression is extraordinary, and no satisfactory explanation has yet been found for the fact.

Another paradox may be found in the recent announcement of Thomas and Hochwalt that solutions of such highly oxidizing agents as potassium nitrate (saltpeter), and even the chlorates and perchlorates of potassium, are far more effective in extinguishing fires, and especially oil fires, than is water alone. The explanation is not clear, the results being attributed to "catalytic effect." Compounds of the alkali metals appear to be almost the only ones to possess this catalytic effect, and the compounds containing oxygen are predominant. A solution of such a powerful oxidizing agent as potassium perchlorate is five times as effective as one of potassium chloride, and nearly twenty times as effective, as a fire extinguisher, as one of sodium chloride, or common salt. These discoveries have already received application in a new type of portable fire extinguisher.

The Hayden Smelter

Part XIII: Revisiting Arizona Mining Camps

By E. H. ROBIE
Associate Editor

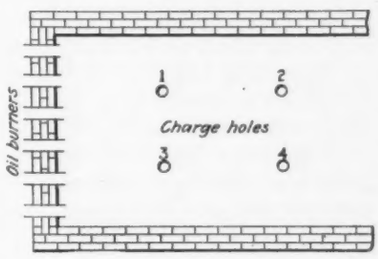
THE Hayden smelter is one of a string of six copper smelters that the American Smelting & Refining Company maintains at strategic points in the western United States and Mexico. Of these, the Garfield plant is the largest, with its immense tonnage of copper produced from Utah Copper concentrates. The others are at Tacoma, El Paso, Matehuala, and San Luis Potosi. The Hayden smelter is a custom plant, like the others, but depends chiefly upon the adjoining Ray concentrator of the Nevada Consolidated Copper Company for its ore.

Separate bins are provided for Ray concentrates, by-products, siliceous flux, limy ore from the Christmas mine, and such other individual lots as may be received for smelting. These are mixed in the proportions needed, by dropping the desired amounts on conveyor belts leading to the roasters. This is not, however, an ideal way of securing a homogeneous charge, as is well realized by Mr. H. Fred Easter, the superintendent of the plant. In my comment on United Verde practice in an earlier article of this series I mentioned the importance there given to a thorough mixing of the charge, for the promotion of rapid and economical smelting.

The effect of selective flotation on the copper smelter is well illustrated at Hayden. Only four roasting furnaces were in use out of the twelve available. Eight of these are McDougalls and four are Herreshoffs, the four in use being of the former type because their location in the plant is more favorable. The sulphur is reduced from 29 to 18 per cent. The usual firebrick hearths are used, firebrick also being employed for lining the shafts, the bond being a special composition obtained from the Denver Fireclay Company. Some consideration was being given to the installation of pyrometers in the roasting furnaces, in order to regulate the heat as closely as possible and thereby prevent the formation of magnetite. This substance, which causes so much trouble in reverberatory smelting at some plants, can be controlled to a large extent in the roasters, and the subject is one that deserves study.

The Hayden reverberatory—for here again I found only one in use out of a possible four—is one of the best examples that I saw on my travels, of advanced center-charging practice. Four holes are provided near the bridge wall of the furnace, as indicated in the accompanying sketch. Directly above these holes are bins holding about 4½ tons each of roasted ore. When the furnace is ready for a charge, the oil and air are first turned off; then a valve is opened in a pipe alongside of the furnace, which admits air to a piston that actuates the bin gates, say Nos. 1 and 4. The charge is immediately dropped in, the total operation consuming only about a minute; whereupon the burners are again turned on. In about twenty minutes the alternate bins are charged, through holes Nos. 2 and 3. This ore charge immediately mixes with the bath of molten material, leaving a smooth surface after a certain amount of boiling, in large part attributable, no doubt, to the presence of high-lime ore, with the resultant liberation of carbon dioxide. No hummocks of ore are left under the charge hoppers, but rather is there a depression in the floor of the furnace at these points, as proved by soundings. Some fettling of the corners of the furnace at the bridge wall is practiced, byproducts being used for this purpose.

The furnace is of the usual silica-brick construction, except for the side walls below the surface level of the molten bath inside, which are of magnesite brick. Low-pressure cooling air is used against the side walls at the hottest points, and the roof is also air-cooled when it becomes thin. The reverberatory here requires more magnesite brick than do the converters, repairs to at least the upper two courses of brick being necessary every time the roof of the furnace is repaired, and of course the silica brick in the side walls above the magnesite need replacing at the same time also. It would seem to me, although I have no official information on this point, that the system of water-cooling the side walls, as used at El Paso, would be superior to the use of magnesite, on furnaces of the center-charged type, though the high content of solids in the Hayden water absolutely precludes the use of water jackets here. Repairs are necessary to the first 30 or 35 ft. of the roof arch about every two or three months. The roof slopes downward toward the flue end of the furnace, no advantage being seen in the straight construction.



Plan of end of furnace

Center charging seems to be working perfectly satisfactorily here; in fact, an improved fuel ratio apparently results, with no offsetting disadvantages. I should like, however, to see some smelter, located out of the United States where the Carson patent would not be an influence, and with two reverberatories in use, employ center charging on one and side charging on the other. Thereby a satisfactory answer might be given as to which is the better practice. But, even then, the problem might be settled only for the individual plant, or the individual ore, in question. Conditions may sometimes favor one, and sometimes the other, practice.

The ore charge to the reverberatory contains about 18 per cent copper and 18 per cent sulphur; the matte, 32 per cent copper; and the slag, 37 per cent silica, 30 iron, 8 lime, 9 alumina, and about 0.36 per cent copper. Should a magnetite layer form between the slag and matte, it can be largely absorbed by temporarily carrying a more siliceous slag and lowering the grade of the matte. Lowering the grade of the matte of course is brought about by increasing the sulphur in the charge through less roasting, indicating that a high temperature in the roasters is the source of the trouble. Trouble from magnetite can be quickly overcome here, I am told.

Samples taken at the slag dump are somewhat higher in copper than the furnace samples, which is not surprising. Should any matte appear on the dump, the remaining slag in the pot is dumped in another place, where it may be recovered.

Skimming of the furnace is continuous, or approximately so.

A marked increase in the efficiency of the waste-heat boilers was recently secured by painting the outside of the brickwork, thus preventing practically all infiltration of air. This was done as far back as the main flue proper. The particular coating used here was a high-temperature flue cement made from gilsonite by the Republic Paint & Varnish Company. It was formerly called "dum-dum."

Three converters are available at Hayden, one of the Great Falls upright type; one an older design of the Peirce-Smith, 9 or 10 ft. in diameter; and the third, one of the newer 13x30-ft. Peirce-Smiths. At the time of my visit the Great Falls type of shell was used principally as a safety valve when more matte is being made than the large Peirce-Smith can handle, the latter being good for only about 100 tons of copper per day on 32 per cent matte. Two complete cycles are finished in 24 hours, and the blows between the skims are of about 30 minutes' duration. The horizontal P.-S. shells do not require relining so often as the upright type; in the latter the large floating mass of siliceous flux doubtless causes some abrasion of the lining, whereas in the former, with all of the flux blown in by the Garr gun, no such mass forms. Also, there is no need to dry the flux when it is to be blown in.

The ladles and pots for matte and slag are of cast steel, the matte ladles being protected by a slag skull in the usual manner. Electric arc welding is used for repairs to the pots, after a plate has been riveted on the outside. The Garfield practice is also to be introduced at Hayden, this consisting in cutting off the noses of the pots, after they are severely worn, and welding on a complete new nose with an electric arc outfit. Thus are the practices of the beauty parlor applied to industry.

Though I have mentioned much idle smelter capacity in the foregoing paragraphs, Mr. Easter tells me that the higher price of copper recently has led to a heavy midsummer smelting campaign, with two reverbs running full tilt, all three converters, and ten roasters.

Coming back to the smelter gate, we passed the stockpiles, where an interesting example of the mechanization and cost saving that characterizes the up-to-date plant was in evidence. Instead of using a team to manipulate the scraper used in trimming the pile, a Little Tugger compressed-air hoist was being used for the purpose. This makes an installation both portable and powerful, and has resulted in an important economy in moving material at this point.

The American Smelting & Refining Company maintains a guest house at Hayden, there being no suitable hotel facilities in the town, but as I had already engaged a room at Winkelman, only a mile or so away, I was unable to take advantage of Mr. Easter's hospitality in that respect. Mrs. Van Akin's place at Winkelman, however, is a most satisfactory hostelry; she is an uncommonly good cook, and the tired traveler will find it a pleasant place to spend a night. As it happened, the power was off after dinner, so there was nothing to do but sit on the porch and watch the clear Arizona starlight on this mild-mannered night in the middle of March. Occasionally, some one would tune in the radio to get the latest reports on the dam disaster in southern California, which had happened a few hours before, but, aside from that, all was silence.

Next week, Mr. Robie will make a brief reference to his visit at the Old Dominion mill at Globe, and in succeeding issues, his impressions of some of the other Phelps Dodge plants will be given.

Geological Survey Map of Salton Basin

A NEW geological survey map has just been issued by the U. S. Department of the Interior covering the heart of the largest area in America below sea level —the Salton Basin of California. This basin includes the famous Imperial Valley, but its deepest part is covered by the Salton Sea, a large, land-locked body of shallow, salty water with a shore line 250 ft. below the sea.

The lowest land in America is found in Death Valley, also in southern California—276 ft. below sea level—but the area of that valley is only 450 square miles, compared with 1,760 square miles in the Salton Basin. It is only of late years, however, that Death Valley has held the low-level record. Prior to 1905 the Salton Basin was the lowest, lying 280 ft. below sea level, but in that year the Colorado River went on an unusually wild rampage and broke through its banks, at a point where the water surface was about 50 ft. above sea level and of course far above the Salton Basin. Through this break the great river poured into the Salton Basin, bidding fair to submerge the whole area, ruin the Imperial Valley and other valleys, and cause untold damage to property. Only the most heroic work by the Southern Pacific Railway averted a great disaster. Left to its own devices the river, after some years, would have created a great inland sea many times the size of the Salton Sea, and perhaps even larger than the Great Salt Lake of Utah. Even the water that flowed into the dried-up basin of the Salton Sea before the Colorado was finally reconfined within its banks raised the level of the Salton Sea from 280 ft. to 244 ft. below sea level. Since that event apparently 6 ft. of water has evaporated.

Among the Indians of the region there is a tradition that many generations ago there was a similar influx of waters from the Colorado which filled the valley. It is probable that there have been several such occurrences during the last 2,000 years, at long intervals, and that during the time between these occurrences the waters of the lake gradually evaporated until it was reduced to dryness.

The map of the Salton Sea and vicinity is engraved and printed on the scale of about 1 in. to 1 mile, and is sold by the Geological Survey, Washington, D. C., for 25c. a copy.

Installation and Operation of Speed Reducers

By Charles Labbe
Clarkdale, Ariz.

PROPER design of speed reducers has been determined by the manufacturers, so that, if they are consulted on the most suitable type for the service desired, no changes should be necessary during or after installation. They are now built for every purpose of speed reduction or acceleration; but service and life depend on right selection before installation and operation. Speed reducers are simple in operation, inclosed and self-oiling, require little attention, and need to be inspected only when they become too noisy, or for repairs.

SMALL speed reducers and their motor drives are mounted upon baseplates. It is important to set the baseplate level; if it is a rough casting or a base built of structural iron, leveling must be done from the shaft of the reducer. After all bolts are tightened, the coupling between motor and reducer must be checked up for alignment and elevation by a machinist's scale across the top and sides of the coupling. If in its proper location, it is best to line it up from the machinery which is to be driven by the reducer, as it is obviously easier to move the reducer and motor to line than to change heavier machinery. Overhead, if possible, permanent eyebolts or an I-beam should be provided to accommodate chain blocks. Large reducers, if they are set on a bedplate, are installed in the same way as small ones, but the bedplate must be supported on the foundation by shims placed at least at every foot, as the weight of the speed reducer and of the motor will bend the bedplate at the center if unsupported and will make difficult the lining up of the coupling. Machinery must be bolted tightly and exactly in place before grouting.

COUPLINGS of small size or of light duty, having flexible material, are lined up with a scale; but heavy-duty, all-metal couplings require more care. The motor and reducer are first leveled and lined by their shafts' centers in relation to the center line of the machine; this is done by stretching a fine wire, from which a plumb line is hung for each shaft center. The finishing at the coupling is accomplished by the use of thickness feelers between the faces. All the bearing caps must be drawn tight, leaving the shaft in its running fit, and all foundation bolts must be tightened evenly when lining up is finished. The lateral play in a motor must be taken into consideration, and the extreme play toward the coupling must have a clearance to avoid pounding. In lining up from herringbone gears, the largest gear shaft must have minimum lateral play, and the pinion shaft must be free to adjust itself in line while running.

On the proper lubricant for a speed reducer depend its service and wear. Hard greases are not recommended, but some automobile greases, such as are used in differentials and gear cases, give good service. The lubricant must be light enough to cover gears and shafts, must cling to the metal, must not be thrown off by centrifugal force, and must adhere to the metal surfaces under the pressure. Lubricants must not be hard or "heavy," so as to congeal in cold weather and thus make the reducer hard to start and to run. Many suitable lubricants are available, it being necessary to consider temperature range and speed. Each machine shipped is either provided with a tag or has marked on a plate the brand or kind of lubricant recommended as most suitable.

OIL level, high and low, is ascertained and marked; as a general rule the lowest gear dips about one inch in oil. Two nipples, elbow and cap, make a good oil gage, but the top of the nipple must be the highest level; otherwise, the excess of oil will overflow. Too much oil in some reducers causes heating, which is detrimental to the lubricant and may cause the operator to suspect mechanical trouble. Glass oil gages are not common, as they are likely to break and thus let most of the oil run out; furthermore, they are useless for heavy oils. Two pet cocks are better than two plugs, as it is easier to ascertain the oil level at any time. After filling the case with the lubricant until it overflows at the high level mark, it is necessary to be sure that all parts are lubricated before starting.

After a speed reducer has been installed it is advisable to run it without load for a reasonable time to ascertain that it is working freely, that no part is heating or binding, and that the oil circulates properly and reaches every part to be lubricated. The nuts holding the packing gland should be tightened with the fingers only, so as not to press the packing against the shaft too much and cause it to heat and cut as the shaft revolves. If a little oil leaks through, the gland can be tightened further.

AFTER an hour or so of running, the reducer will be uniformly heated. If the heating is local, such as a shaft, bushing, or stud, it is advisable, if the part is within easy reach, to take it apart and to scrape and polish the high spots. But should the heated part be inside, it is safer to run the machine without load until the part is warm, and then to shut down and let it cool and start again. Some shafts, after running warm the first twenty minutes, when stopped and cooled and started again may not heat for an hour; after again stopping and cooling they may take a still longer time in which to heat again. This is proof that a high spot is wearing down to place. Such a condition improves after "running in." If the condition grows worse, the reducer must be taken apart and an investigation made as to the cause.

If there is trouble, several things can be tested; oil holes should be drilled through where intended; oil grooves must connect to oil holes or oil chambers; hard grease may have been used and the oil passages may have become choked; and grease, when trapped and heated, sometimes forms a hard substance that must be scraped off. New machines are sometimes fitted too tightly all over and require much preliminary running before being placed in service. Part of the frame or case may have been tightened too much, causing distortion, which may be remedied by slightly loosening the bolts of the case or the capscrews holding the flanges or bushings. The heating of a shaft may also cause a thrust bearing or collar to heat; error in the setting of a coupling may be the cause.

THE oil level should be watched so as to prevent it from dropping below the safety point. If there is no air vent, the top filling plug, or inspection plate, is left open, as the heat generated will cause a slight pressure, which will force some oil out at the shaft packing or at any bearing. Heavy oils used in speed reducers maintain their consistency up to a temperature of from 120 to 140 deg. F., beyond which they may lose much of their efficiency. After the first week's run, oil should be drained out and renewed. It may be advisable also to wash out the case with kerosene before refilling. A sediment chamber should be provided with a plug at the lowest point of the base.

Repair parts are seldom kept on hand for speed reducers, as the part that may require renewal is uncertain; it may be a shaft near the shoulder of a gear or a stud holding an intermediate gear; teeth may break; capscrews may shear or twist off; a cover or flange may be sprung or broken; or the frame may break. This is the work of the repair mechanic in a machine shop where the broken pieces can be welded or even a new piece made, if necessary.

If a speed reducer has not been installed properly, or if there is a defect in construction, a noise will soon develop. The high-speed reducers, 3,000 to 5,000 r.p.m., sometimes develop noisy couplings. The cause may be lack of proper lubrication, too narrow bearing faces for the load, insufficient lateral motion, or shafts out of line. A flexible coupling for high speed and heavy duty must be lined correctly, as the flexible feature provides for the difference in bearing wear, heat distortion, and misalignment of only a few thousandths of an inch; otherwise they will be noisy and will not last. Couplings for medium speed, 1,000 to 2,000 r.p.m., are usually equipped with studs and rubber bushings and give good service; slow-speed reducers, metal to metal, often live through any condition without requiring that any particular attention be given them.

GEARS, machined and finished all over, have no chance of being out of balance, but with service the usual wear takes place. Worn studs and bushings must be replaced by new ones; expensive shafts have their journals trued on the lathe, but for smaller parts it is best to keep them to standard sizes. Few gears or pinions can be re-trued on a lathe, because they are worn usually to the safe limit; especially cast-iron gears, where the new tooth face may not mesh properly with one of the old or worn shape, thus causing the breaking of teeth. If gears are intended to be turned over for addition wear, they must be designed with a wide tooth base. Many of the larger worms can be turned over for new wear: small ones are pressed off the shaft and turned over; large ones held by bolts or capscrews are removed and also turned over, the holes corresponding and the bolts fitting snugly.

THRUST bearings and ball bearings should be inspected for wear and dents. If not badly damaged they can be trued up on a lathe in the following way: The ball race is held in a chuck, and a copper washer, shaped to correspond to the ball race, is mounted on a mandrel. While the ball race is revolving, the copper disk is smeared with emery and kerosene and pressed against the hardened ball race. No chances should be taken with damaged rollers or cones; they may ruin a whole bearing and shaft in a short time. Large shafts can be inspected for defects or cracks, as is done for large engine parts. The shaft is wiped clean, washed with gasoline, and wiped dry. It is painted with whitewash (made of lime or chalk) and left to dry. Any crack will then show up as a dark yellow streak.

It is necessary to renew all the bearings of herringbone gear shafts with the same material, so that they will wear alike. In rebabbitting bearings, the anchoring should be ample, so that the babbitt will not get loose. Dovetailed grooves should be cut or holes drilled either radially through the sides or endwise, parallel with the shell, breaking out the inner wall. In renewed bearings, if possible, two sets of oil holes and grooves should be provided, as little additional time is required and lubricating conditions are improved.

Gypsum Production Declined Slightly Last Year

THE gypsum industry in 1927, though very active, was not quite so productive as in 1926, according to a statement made public by the U. S. Bureau of Mines, based on reports received from 60 operators in 17 states. The quantity of gypsum mined in the United States in 1927 was 5,346,888 tons, a decrease of 288,553 tons, or 5 per cent, compared with the record for 1926. This production has been exceeded only in 1925 and 1926, and was about twice as large as that ten years ago, in 1927.

Total value of the gypsum sold or used by producers was $42,174,454, a decrease of $4,546,765, or 10 per cent, compared with 1926. The quantity of gypsum sold by producers without calcining in 1927 was 965,371 tons, a slight increase over 1926, and was valued at $2,388,663, or $2.47 per ton, a decrease of 14c. per ton; the quantity of calcined gypsum sold or used by producers was 3,912,211 tons, a decrease of 103,763 tons, or 3 per cent, and was valued at $39,785,791, or $10.17 per ton. This was a decrease of 10 per cent in total value and 84c. per ton compared with the figures for the gypsum production of 1926.

New York continues to be the largest producer of gypsum. Production of crude gypsum in that state was 1,675,501 tons in 1927, a decrease of 3 per cent from that of 1926. This was nearly one-third of the entire quantity mined in the United States and more than twice as large as the production of the second state, Iowa. Other states producing crude cypsum in 1927 were Iowa, 792,159 tons; Michigan, 668,617 tons; Texas, 508,382 tons; Ohio, 474,320 tons; Nevada, 327,365 tons; and Oklahoma, 271,484 tons.

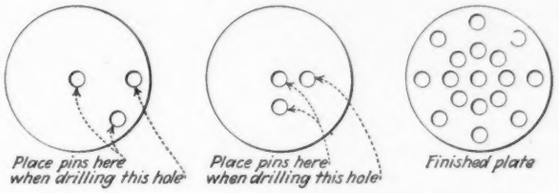
USEFUL OPERATING IDEAS

Drilling Holes in Screen Plates

By R. M. Thomas
Denver, Colo.

IDEA No. 1

HAVING several drain plates to make with holes in them as in the illustration, we used the following method with good results. After drilling the center hole, we drilled a hole the same size in a plate which was anchored to the drill-press table. Then, after placing a pin through this hole into the bottom



Sketch showing method of drilling holes in screen plates

plate, we moved the drill-press table over into position for the next hole in the plate. After drilling this hole in the top and bottom plate we used this as a dowel-pin hole until all holes of this series were finished. We drilled all the holes of this layout on all the plates; then moved over to the next holes and repeated the operation as on other holes.

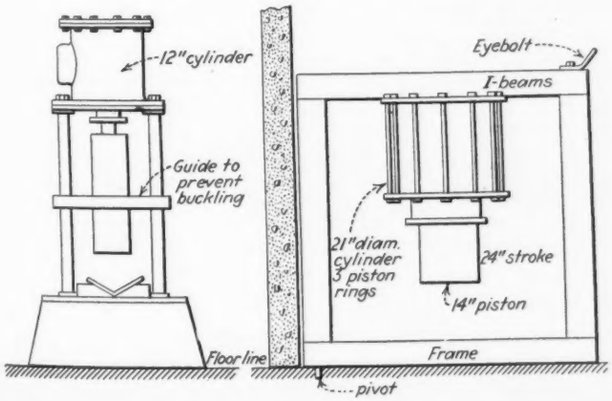
Straightening Presses

IDEA No. 2

STRAIGHTENING of pipes, plates, and miscellaneous materials is always necessary in a general mine shop. At the Hecla mine, Burke, Idaho, J. B. Sloan, master mechanic, designed and had constructed in the company's shops two presses for this service. The smaller press was made from a discarded pump cylinder, 12 in. in diameter. Its cylinder is supported in a vertical position by four standards fastened to the bedplate. The regular piston is attached to a prolong of larger diameter which is supported by a guide as shown in the accompanying sketch. A four-way valve is used for operation. With 100 lb. of air the total pressure is 5.6 tons.

A larger press, with a 21-in. diameter cylinder suspended from a rectangular frame of I-beams and channels, and with a 14-in. diameter piston, is also used. The frame is swung about a pivot so as to be moved back toward a wall when not in use. It is swung out by means of the overhead traveling crane. The press exerts an effective pressure of about sixteen tons.

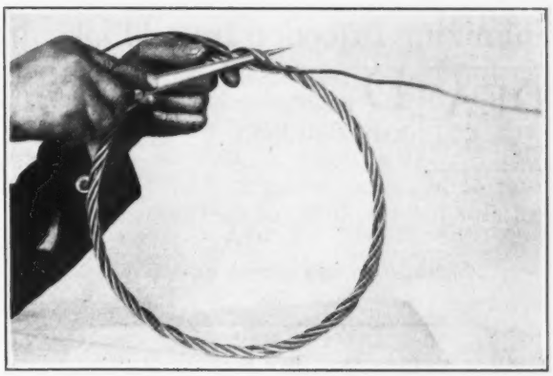
Two presses for straightening pipes and plates



How to Make a Ring of Wire Rope

IDEA No. 3

A RING formed of steel cable will often be found useful as a sling. A perfectly smooth ring may be made by splicing the cable as follows: A length of cable seven times longer than the circumference of the desired ring is cut, and then the cable strands are separated. One of the strands is selected for the



The final operation. Working the free ends of the strand into the ring

ring, and the others are saved for other rings. At the center of the strand a length equal to the circumference of the ring to be made is marked off and the strand is wound into a one-turn circle so that equal amounts of the strand will be left over at each end. Wrap the strand by working with one end until it has been entirely wound around the ring and but one-half turn remains. After this has been done the other end is treated the same way.

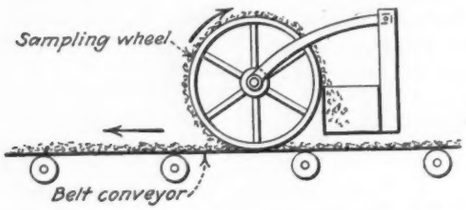
At this point a spike is inserted in the ring where the two ends cross so as to lift two strands. The spike is now turned slowly around in a clockwise direction through the ring without permitting it to come out from between the strands. As it is turned, it will gradually move forward like a screw and the loose strand will be

pushed before it, disappearing into the center of the ring. The same is done with the other loose strand, the ring being turned about so that the remaining end projects away from the operator. When the ring is completed, both strands should meet each other and be in the center of the cable ring, which will be of the desired diameter and will have the same thickness as the original cable. Any uneven places in the ring may be smoothed out between two mallets. This method was developed in the Westinghouse shops at East Pittsburgh, Pa.

Sampling Vacuum Filter Discharge

IDEA No. 4

A NOVEL and effective method of sampling the residue from a battery of American disk filters is in operation at the mill of the McIntyre Porcupine Mines, Ltd., at Timmins, Ont. Noting how material built up on the mud guard of his automobile, the superintendent reasoned that a wheel would make a good sampler for residue being conveyed on a belt. The accompanying illustration depicts how the idea was put into effect. A small wire scraper, to remove excess of slime before the deflector and sample box are reached, is not shown in the sketch.



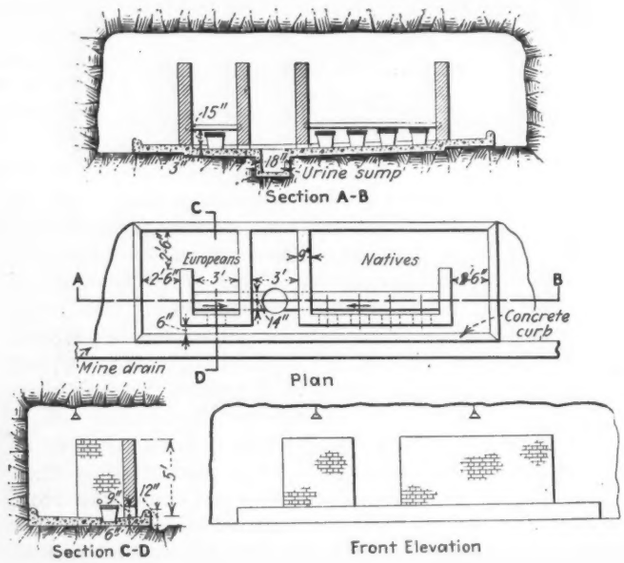
Sampling filter tailing on a moving belt

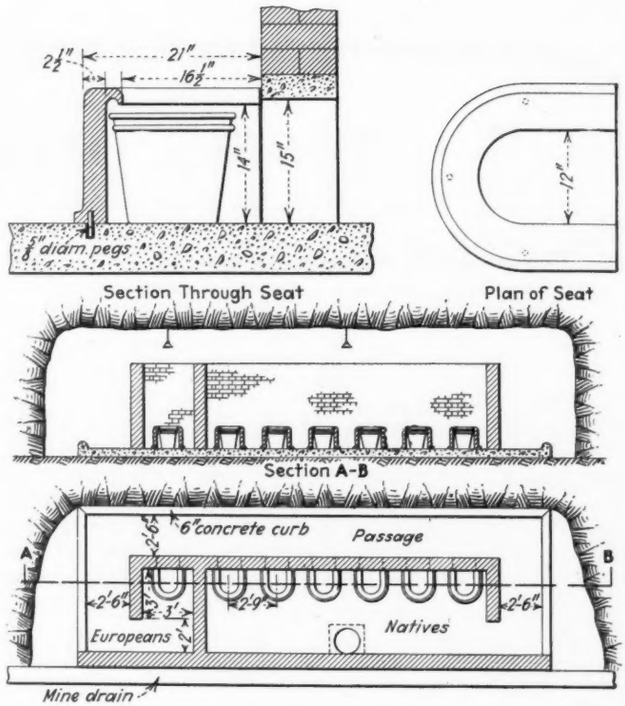
Minimizing Infection from Hookworm

IDEA No. 5

DESIGNS of latrines intended to minimize infection from hookworm were distributed to mine managers on the Rand in 1927 by the Transvaal Chamber of Mines, according to A. J. Orenstein in the *Journal* (for January, 1928) of the Chemical, Metallurgical and Mining Society of South Africa. Two of these are shown in the accompanying illustrations. The ideal latrine to minimize infection from this cause is one in which the excreta are so placed that they cannot contaminate the floor of the latrine or the surroundings. As this is impossible in practice underground, it is of the utmost importance that the floors of underground latrines and of surface latrines where buckets are used should be impermeable and provided with sufficiently high curbs to prevent excreta reaching the ground. The designs shown answer this purpose.

An underground latrine on the Rand



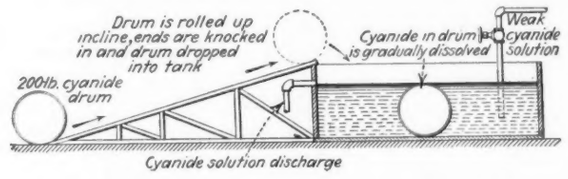


Another type of mine latrine designed to prevent infection from hookworm

Effective Plan to Avoid Handling Cyanide

IDEA No. 6

REDUCTION of poison hazard and discomfort, simplification of operations, and increased general efficiency are the results of a simple plan put into effect at the McIntyre plant, at Timmins, Ont. The drum of cyanide, after being rolled up a short incline and having the ends knocked out, is submerged in a tank, as shown, through which water or weak solution is passed. The cyanide gradually dissolves, and the handling of a poisonous and irritating chemical is thereby avoided.


Drum is rolled up incline, ends are knocked in and drum dropped into tank
Cyanide in drum is gradually dissolved
Weak cyanide solution
200 lb. cyanide drum
Cyanide solution discharge

A safe way of handling drums of cyanide

BY THE WAY

The Ballad of Mokelumne Ed.

OF ALL the great men of the Mother Lode,
The greatest of all, 'tis said,
Was a moth-eaten codger without any hair
Whom they called Mokelumne Ed.
On the eight hundred foot of the Roarin' Mine
He stood at the end of a drift,
And spat wide and handsome and cursed the breast
Just left by the previous shift.

Headframe of the Roarin' Mine—or its counterpart

Not a color was there or a sulphuret,
Not a fissure to follow or trace;
He knew he had come to the end of his rope
As he studied that barren face.
So he went up on top and he fired the men,
He felt that life was a fake;
But he packed up a burro and started out
To make him another stake.
He wandered along to Columbia town,
A camp of an ancient day,
Where the lime stuck out like the stones on the graves
Of the men who had passed that way.
This little old town was a placer camp
And the old fellows sure were keen;
They had worked the diggings time and again
And scraped the bedrock clean.
And after them came the China horde
Who could live on a Lima bean,
And they panned what little the white men left
Because it was barren or lean.
So there wasn't much chance for Mokelumne Ed.
In that land of the long ago,
Where the wraiths of the miners who swarmed the place
Seemed to pass in a ghostly row.
He sat himself down to his noonday lunch
In the graveyard close by the church
That rested high on a gravel bank
Like a white bird asleep on his perch.
And thus, as he sat on a crumbling stone,
And spat on a grassy mound,
A thought flashed into his sunburned head:
He was sitting on holy ground,
And the gravel that lay just under his feet
Was surely a virgin bed,
For the old chaps no matter how tough they were
Didn't sluice out the graves of their dead.
So he put up his camp close down by the creek
As a base for his furtive search,
And started a tunnel a long ways off
To end just under the church,
So that passers-by, who saw his work,
Would never suspect his lay,
They would think he was only another poor nut
Who was digging his life away.
For two long months he shoveled and trammed
And at last he reached his goal
Where the ancient channel would be exposed
At the end of his gopher hole.
But what did he find but a 'niner's pan
And close by a rusty pick?
And when he uncovered an old mine car
His heart was truly sick.
For some old timer had figured the same,
And put in his secret bore,
And beaten Ed. to that sacred place
Just fifty years before.
Though sore at first, he soon came to
And considered it all a joke,
For there ain't no luck in robbing a church,
Or stealing a blind man's poke.

Church at Columbia. Limestone bedrock in foreground

So he hied himself back to the hard-rock game
Where there's smoke and dust and grime,
And he worked all alone in the Roarin' Mine
For he hadn't a sou or a dime.
He worked two shifts on every day
In that slaty, barren land,
And one day broke into a pocket of ore
With nuggets as big as your hand.
Old Ed. at last had made his stake
And he wanted the world to know,
So he started out on a gilded trail
To see how much he could blow.
He imported a band from Frisco
And a musical show from the East
And he gave all his friends a champagne souse
That rivaled Belshazzar's feast.
He built him a house with a bathtub
Where a man could sit and boil,
He sure had a rip snortin' hell of a time
Till he started to dabble in oil.
The first well he sank was a gasser,
The second was dry as a shake,
The third well, they say, was the outlet
Of the waters of Great Salt Lake.
And so if you ever happen
In the region of Poker Flat
Just drop in on Ed. and give him a chew
And stop for a friendly chat.

—WALTER S. WEEKS

COMMENT AND CRITICISM

Too Much Big Business in Government?

THE EDITOR:

Sir—I cordially endorse the views expressed by N. E. Guyot in your issue of June 23 regarding the attempts of the bureaucrats of the federal government to monopolize the public domain on behalf of private interests carefully hidden behind their grandstand.

It was so in 1914 in the abortive attempt to "nationalize" the radium industry. The grandstand then was fixed up to look like "public health," and the euphonisms to lull and gull the public were labeled "this God-given gift to suffering humanity." I notice that the mines are still there, humanity is still here and still suffering, but the bureaucrats are beating another big, empty drum.

Bear in mind that I can see no good reason why the Bureau of Mines could not do work which would be of immense value to the development of the mining industry of the United States. But it is only too true that up to date it has been manipulated as a whip of the big corporations and banking interests.

Pittsburgh. T. F. V. CURRAN.

The El Fuerte Reorganization—A Correction

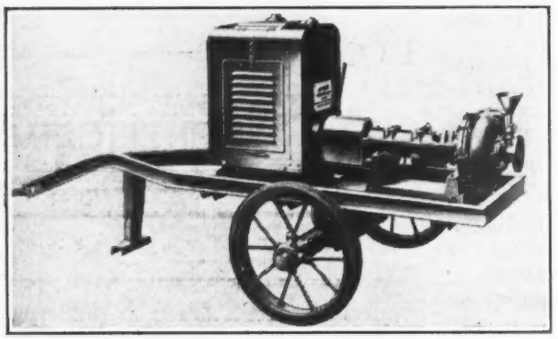
THE EDITOR:

Sir—We note that on page 68 of your issue of July 14, 1928, you have published a statement about the formation of El Fuerte Mining Company, of Delaware, by the merger of three other companies. That portion of your news item was correct. The statement that 10,000,000 shares of El Fuerte Mining were distributed to the three companies was wrong. The authorized capital of El Fuerte Mining Company is 10,000,000 shares, par value $1, and but 3,000,000 shares are to be issued in payment for the nineteen mining properties, a townsite and plant, and other equipment of the three merging companies. The remaining 7,000,000 shares of the authorized capital are a reserve for use in further financing operation and equipment of the properties.

EL FUERTE MINING & SMELTING COMPANY.

Los Angeles.

INDUSTRIAL PROGRESS



Portable pumping unit. Manganese steel has been used in its construction.

The Equipment Review

VARIOUS pieces of equipment of interest to the mining and metallurgical industries have recently been announced by manufacturers. Among them are a new crawler crane, shovel, and dragline, a portable pump of manganese steel, a chain hoist, a new design of overhead traveling crane, an improved magnetic separator, and certain other interesting products.

The Shovel-Crane

To its line of crawler cranes, shovels and draglines the Link-Belt Company has added a new 2-yd. machine (K-55). As indicated, this machine is adapted for use in several ways: (1) As a shovel with a 30-ft. boom and an 18-ft. dipper stick, carrying a 2-yd. all-manganese-steel dipper. (2) The machine may also be used as a dragline to handle a 2-yd. bucket for medium and extra-heavy excavating on a 50-ft. boom, or a 1½-yd. dragline bucket on a 60-ft. boom. (3) It may also be equipped with a 2-yd. clamshell bucket for moving sand, gravel, or materials of equal weight per cubic foot and consistency, on a 50-ft. boom; or a 1½-yd. bucket on a 60-ft. boom. It will handle an equivalent weight of heavier or lighter materials. (4) It may also be used as a trench shovel of 2-yd. capacity. In all these applications the capacity is two full cubic yards. All attachments are interchangeable without disturbing the driving mechanism of the machine. A collapsible mast is provided, and special shipping treads, which may be quickly substituted for the working treads so as to bring the machine within railroad clearance requirements of 10 ft. 4 in. over-all width and 16 ft. over-all height above the top of rail when loaded on a flat car. In working condition the machine is 12 ft. wide over-all at the lower frame, which gives it ample stability for the work for which it is designed. Crawler treads are 36 in. wide. The machine is built to be driven with gasoline engine, electric motor, or Diesel engine.

A Portable Pump

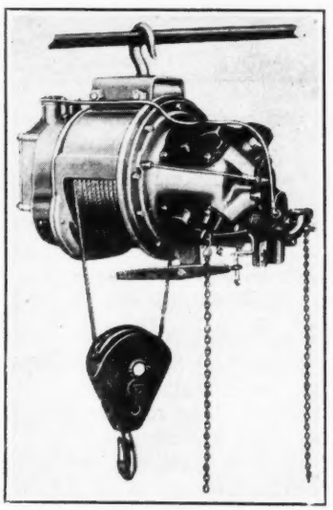
One of the accompanying illustrations shows a portable pumping unit of manganese steel introduced by the American Manganese Steel Company. This is made with discharges of three sizes—namely, 2 in., 2½ in., and 3 in., powered respectively with a 6-hp., 8-hp., and 10-hp. Novo engine (at 1,200 r.p.m.). The 2-in. unit has a capacity of 100 gal. per minute against a 34-ft. lift with no horizontal discharge hose, and will maintain the same flow through 125 ft. of 2-in. hose without vertical lift, according to the manufacturer. The 2½-in. unit has a capacity of 150 gal. per minute against a 34-ft. lift with no horizontal hose, or through 150 ft. of 2½-in. hose without a lift. Likewise, the 3-in. unit can handle 230 gal. per minute against a 37-ft. lift, or it can maintain the same flow through 200 ft. of horizontal hose. All parts are proportioned for maximum wear.

The Shop

A complete line of dies for brass pipe only has been introduced by the Armstrong Company, of Bridgeport, Conn.

An Air Hoist

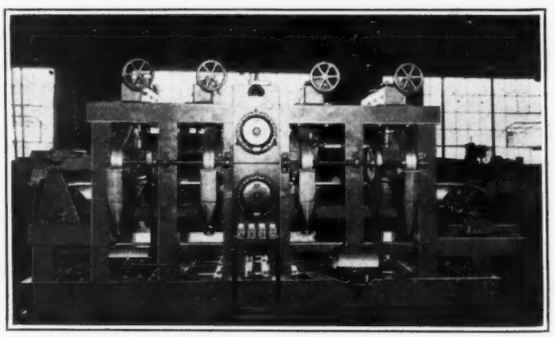
A line of air hoists embodying various distinctive features has been introduced by the Chicago Pneumatic Tool Company, 6 East 44th St., New York. One of these is shown in the accompanying illustration. The sizes available have capacities of 2,000, 3,000 and 4,000 lb. respectively and have an inclosed-type load block. The motor is four-cylinder and single-acting, and is practically vibrationless. Less headroom than is customarily needed is required. Smooth and positive control is obtained by means of the balanced control valve used. Lifting speed has been increased, the one-ton hoist being able to lift 2,000 lb. at 40 ft. per minute.



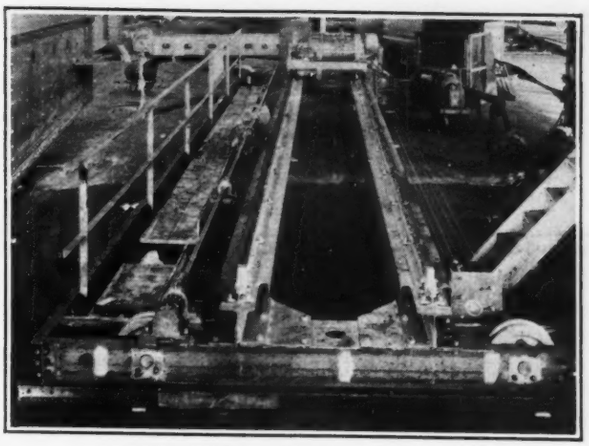
A new motor-driven air hoist

Magnetic Separator Redesigned

Recently, a magnetic separator of improved design and weighing a little more than 25,000 lb. has been furnished a producer of abrasive materials by the Magnetic Manufacturing Company of Milwaukee. This machine is of the



Magnetic separator of improved type for handling abrasive materials.



A 5-ton overhead traveling crane of the I-beam girder type, fabricated by welding

cross-belt type and is known as the type R high-duty cross-belt separator. Two magnets are provided, one having 60,000 amp.-turns and the other 100,000 amp.-turns. The main conveyor belt is 18 in. wide. The machine is shown in the accompanying illustration. Speed of the cross belt may be varied from 100 to 1,000 ft. per minute almost instantaneously. Approximately ½ hp. is required for operating the cross belt and the main conveyor belt. The magnetic gap can be increased or decreased as desired, by means of a worm gear with hand-wheel control.

Corrugated Wire Glass

Two samples of heavy corrugated wire glass have been received, the manufacturer being the Pennsylvania Wire Glass Company, of Philadelphia. The product is being marketed by the Hires-Turner Glass Company. In this article the glass is $\frac{7}{16}$ of an inch in thickness, and thicker at the apex of the corrugation. The corrugations are 1 in. deep and 1½ in. apart from apex to apex. The glass may be had either clear or in a brownish color, the latter also being transparent. The colored glass is said by the manufacturer to cause a shadow, thereby eliminating heat and glare of the sun. This glass is being used for skylights, among other purposes, it is said.

Traveling Crane Arc Welded

A new design of overhead traveling crane, in which the bridge girders, end trucks, and trolley are constructed by arc welding, has been announced by the Cleveland Crane & Engineering Company, Wickliffe, Ohio. The accompanying illustration shows a five-ton crane of the I-beam girder type. The span is 38 ft. 9¼ in. Each girder is reinforced throughout its entire length by angles arc-welded to the standard I-beam sections. Riveted girders of similar construction would employ a channel section instead of the two angles, it is stated, despite which they would not be equally strong or rigid. The girders are attached to the end trucks by the notched or shoulder construction to prevent weaving. On shipping, the girders and trucks are disassembled and are reassembled in the field by use of bolts. However, the manufacturer recommends additional arc-welded reinforcement to secure the maximum rigidity. The end trucks themselves are built up of two standard channel sections joined by arc welding. Roller bearings are used.

Indicating and Recording Instruments

Aluminum cases are now being supplied as standard equipment with the recording thermometers and pressure gages manufactured by the Brown Instrument Company, of Philadelphia. It is interesting to note that the cases for the continuous chart recorders are among the largest aluminum die castings yet produced on a quantity basis.

Refractory Brick

A new refractory brick, known as "Acido," has recently been introduced by the General Refractories Company, Philadelphia. It is highly resistant to acid attack. It was developed for service where resistance to dilute or concentrated acids is desirable. The brick is made from a clay specially selected for acid resistance and which can be treated and burned to produce a dense, impervious body. It is machine-made.

To Study Effect of Lightning on High-Voltage Transmission Lines

ONE of the major battles of peace time, that of the technical mind against lightning, is about to start in a lonely mountain spot in Tennessee. During the next six months, according to W. S. Rugg, vice-president of the Westinghouse Electric & Manufacturing Company, electrical engineers of his company, armed with every scientific device obtainable, will record each bolt and quirk of every thunderstorm that plays around the crest of Chilhowee Mountain. Since the site where the apparatus is to be located, Chota, Tenn., has an average of twenty thunderstorms each month during the summer, the engineers will have an active time, states Mr. Rugg, who believes that data concerning the effect of lightning on high-voltage transmission lines will be recorded in such detail that the development of lightning-proof apparatus will be greatly facilitated.

Experts today are far from agreement as to the characteristics of lightning or its effects on high-power transmission lines. There is, for example, a difference in opinion, representing a ratio of 1,000 to 1, of what present-day authorities declare to be the "rate of onset" of a lightning bolt. Existing data concerning the effect of surges induced in power lines by adjacent lightning strokes and that set up by direct hits are not accurate. This difference in opinion is one of the major factors that the Westinghouse investigations are expected to make clear.

Lightning, to date, has been the unknown quantity that prevented the designing engineer from producing apparatus that would function despite what in legal terminology is spoken of as an "act of God."

INDUSTRIAL NOTES

The Dominion Equipment & Supply Company, of 145 East Market St., Winnipeg, has been appointed general agent for distribution of Sullivan equipment in Manitoba for mines, contractors, and industrial and municipal business. These lines include rock drills, air compressors (both portable and stationary), drill steel sharpeners and furnaces, concrete breakers, clay spaders, air lift pumping equipment, and diamond core drills.

David Newhall has succeeded John S. Latta as manager of the Philadelphia branch of the Manhattan Rubber Manufacturing Company. This branch is located at 2132 Market St.

E. D. Bullard Company have appointed J. J. Delahide as sales manager for their Rocky Mountain division, with headquarters at Salt Lake City.

B. M. Mitchell, president of the Conveying Weigher Company, has been elected an honorary and life member of the American Society of Mechanical Engineers.

The Edgar Allen Steel Company, of Chicago, announces that hereafter the address of its New York office will be 741 Washington St., and that its office in Chicago will be located at 21 North May St.

The Straub Manufacturing Company, Oakland, Calif., has organized a metallurgical division, comprising a laboratory and ore-testing plant, in order to serve its clients more completely. Charles P. Richmond will be in charge.

BULLETINS

The Superheater Company, 17 East 42d St., New York, has reprinted in pamphlet form the steam tables included in the seventh edition of "Superheat Engineering Data," which it issued several months ago.

PATENTS

CRUSHER ROLL. No. 1,670,381. May 22, 1928. Charles B. Rogers, Joplin, Mo.

ROCK DRILL VALVE. No. 1,671,431. May 29, 1928. E. B. Lear, assignor to Ingersoll-Rand Company.

ROTARY MILL. No. 1,671,243. May 29, 1928. Johannes Ihlefeldt, assignor to the Firm G. Polysius, Dessau, Germany.

NEWS OF THE WEEK

Summary

CONSOLIDATED Mining & Smelting has exercised its option on the Big Missouri property, north of Stewart, in the Portland Canal district. Development of the gold-silver deposits there has been going on for the last six months. Buena Vista Mining is the name of the new operating company. Page 188.

* * *

The new Penpoll tin smelter of Anglo-Oriental will treat not only ores from the company's Nigerian properties but from the Far East as well. It is possible that an agreement may be effected with some of the Bolivian producers for their output. Page 190.

* * *

Magna Gold, situated in Lander County, Nev., is steadily increasing the scope of its operations. Starting this month it will be worked on a three-shift basis. Page 191.

* * *

A thorough geological examination of the Park Premier property, in the Park City district, is being undertaken by International Smelting, which recently acquired control. The smelting company now has control of one mine in each of the important districts in the Salt Lake Valley. Page 187.

* * *

Gold mining in Southern Rhodesia may be considerably increased as the result of renewed exploitation of old mines that had been prematurely abandoned. Page 190.

* * *

Gold Road mine, in the Oatman district of Arizona, will be reopened. New hoist erected at Tom Reed, in the same district. Old Colony development at Stockton Hill is progressing. Page 187.

* * *

Butte Copper Consolidated has found the extensions of three orebodies within 40 ft. of the main shaft on the 400 level. Shipments from this property at Radersburg are being effected regularly. Montana-Idaho is treating 140 tons daily at its Spring Hill plant. Page 191.

Turner Authorizes Addition of Six New Men to Mining Division Staff

By Paul Wooton

Special Washington Correspondent

SO AS to carry forward the special study being made of mining methods and costs, Scott Turner, Director of the U. S. Bureau of Mines, has authorized the addition of six members to the staff of the mining division. Operators of metal mines, as well as of coal mines, have signified their willingness to cooperate in the collecting of details on labor, efficiency, supplies consumption, and costs, so that all interested in mining may have comparative data that may be used as a basis for analyzing their results in mining. As in the metallurgical and ore-dressing plants, of which many detailed results have been published, availability of knowledge of how and at what cost the other operator is producing is expected to provide an incentive to improve methods and reduce operating costs.

In Michigan, Dr. W. R. Crane has spent the last two years making detailed studies at the copper and iron mines on ground movement and subsidence. These studies have for their purpose the determination of the factors causing, controlling, and directing failure caused by mining operations. The investigation includes a study of methods of mining as related to the problem of support and maintenance of workings. In this way, it is hoped to secure fundamental data upon which a definite method of procedure in the protection of property against damage resulting from mining may be based. The field work for this report is finished. The manuscript and illustrations are in the course of preparation, and soon will be completed, it is expected.

Results of these studies at the mines examined have been most valuable to the mine operators, as they have aided them in the protection of the mine and property, as well as the workmen, against ground movement.

Dr. Crane has also prepared a bulletin on "The Methods of Mining and Costs at the Lake Superior Copper Mines." The purpose of this study is to supply the mine operator with diagrams and descriptions showing just how the methods are applied and the results obtained. The manuscript on the mining methods is completed, and details as to latest mining practice and tables, showing costs and consumption of supplies for each method, are being added. The report will be completed in a few months.

In Arizona, E. D. Gardner has made a valuable study of drilling and blasting in open-cut copper mines (See Bulletin 273, U. S. Bureau of Mines, 1927), and now is completing a study of drilling and blasting in drifts. The object of this latter investigation has been to ascertain the best methods of drilling drift rounds, the safest and most efficient explosive to use under various conditions, and a method of classifying ground in order to use explosive economically.

The following advance chapters have been published:

"Charging Explosives in Drill Holes of Drift Rounds in Metal Mines," by E. D. Gardner, Reports of Investigations, Serial No. 2789; and "Chambering Cut Holes of Drift Rounds in a Western Metal Mine," by E. D. Gardner, Reports of Investigations, Serial No. 2855.

Mr. Gardner's future work will consist of a study of mining methods and costs in the Western states. Bulletins on each principal mining district will be made; also, technical papers embracing a single mining method are to be published. The purpose of these studies is to supply data that can be used for comparison of the different mining methods, as to results, and that may aid the operator in increasing his efficiency results as well as in reducing the losses of mineral in mining. Mr. Gardner is to have two assistant engineers to aid him in these new investigations.

Virginia Mine Is Retimbering Shafts and Lower Drifts

Unwatering of the Virginia mine of Nevada Hills Mining, near Coulterville, Mariposa County, Calif., has been completed, and the lower drifts and incline shaft are being retimbered. The shaft reaches a depth of 900 ft., and workings total 10,000 ft. in length. Electric power for pumping and hoisting is available. The property had been idle since 1923, when the Virginia-Belmont Mining Company, which owned it at the time, shut down after operating continuously for several years.

Gold Road Mine, in Oatman District, Is Purchased

New Electric Hoist Installed at Tom Reed—Tunnels at Old Colony Advanced 300 Ft.

A GROUP of Los Angeles men recently took over the old Gold Road mine, at Oatman, Ariz., and operations are to be resumed at once. The new company is known as Gold Road Mining. Stopes will be opened along the Line Road tunnel and drifting will be started from No. 1 shaft. The mill will be started as soon as possible. It is expected that it will handle 100 tons a day. Frank Onetto, who held a lease on the property before it was acquired by the new company, is to be in charge of underground work. R. H. Milne is the superintendent. The mine was first discovered in the early 'nineties, and has a production record of $10,000,000, it is said.

A new electric hoist has been installed at the Black Eagle shaft at the Tom Reed mine, also situated in the Oatman district. Drifting is being continued toward the Aztec oreshoot from the 800 level of the shaft. The Gavin and Gillan leases, which are on the property of the Tom Reed company, recently shipped 40 tons of ore, valued at $80 a ton, to the mill.

Iron Mountain Purchases Empire Development Mine

IRON Mountain Lead & Zinc has purchased the Empire Development mine, situated southwest of Baxter Springs, Kan. The consideration is said to have been about $300,000. The mine lease includes 80 acres, from which production has been effected since 1920. The mill is a little more than a year old. John Reigart, of Iron Mountain, Mich., is in charge of the mine, with headquarters at Joplin, Mo.

At the Old Colony property, on Stockton Hill, near Kingman, Ariz., the tunnel on the 4,550 level and that on the 5,050 level have been advanced more than 300 ft. from the portals. A crosscut from the original tunnel, situated 4,200 ft. above sea level, is being driven to the Prince George vein, which should be encountered at a depth of 170 ft. below the old workings. This development is being prosecuted by Canadian capital. F. M. Manson is in charge of operations, which are expected to bring this lead-zinc-silver property into production again, following cessation of operations last year.

Shaft sinking at Johnson Copper, in Cochise County, Ariz., has reached 330 ft. Ralph R. Wilson, vice-president of the company, reports a strike of 30 in. of high-grade carbonate ore, carrying copper, silver, and some gold, at a depth of 270 ft. A station will be cut at the 350 level and a crosscut will be driven under the vein discovered at 270 ft. Two shifts are being worked, and the operators expect to start shipments in September.

International Smelting Will Develop Park Premier

A THOROUGH geological study, preparatory to active development, of the property of Park Premier Mining is being made by International Smelting, a subsidiary of Anaconda Copper, which recently acquired control of the property. It consists of more than 3,000 acres, situated just south of Keetley, Utah, in the Park City silver-lead-zinc district. J. O. Elton, manager of International Smelting, will be president of the new company. The other officers are George W. Snyder, vice-president; A. D. Hunter, secretary-treasurer; and G. M. Snyder and Tom Lyon, directors.

The production of the Park Premier mine will be sent to the Tooele plant of International Smelting for treatment. This mine will give the smelting company one property in each of the important producing districts near Salt Lake City. It already controls the output of Utah Delaware, at Bingham, and the North Lily, at Tintic.

Mile-Long Tunnel for Motor Traffic in Utah

THE National Park Service, of the U. S. Department of the Interior, announces that reports from the field are to the effect that the spectacular mile-long tunnel which is being driven through the sandstone walls of Zion Canyon, in Utah, is nearing completion. The contractors are advancing this tunnel at the rate of 37 ft. per day. It is now about 80 per cent completed and is expected to be finished in another month.

The tunnel is a part of the Zion-Mount Carmel Highway which the U. S. Bureau of Public Roads is engaged in building for the National Park Service. A mile of this tunneling through solid sandstone seems like a difficult undertaking, but when it is finished it will be followed by further work of the same sort on this same highway, which in the end will bring this kind of construction up to about 5 miles. In addition to the boring of the tunnels, galleries are opened up every 1,000 ft. or so which make it possible for travelers on this highway to look out into the canyon—one of the choicest bits of scenery in the West.

Hecla Shaft, Down 2,800 Ft., Will Be Continued to 3,200

Hecla Mining's main shaft at Burke, Idaho, has reached a depth of 2,800 ft., according to James F. McCarthy, president and general manager of the company. It will be continued to a depth of 3,200 ft., after a station has been cut at the 2,800 level. Development work below 2,400 ft. is being prosecuted through a winze. The mine now has a daily output of 950 tons of silver-lead ore.

Mr. McCarthy recently visited the Union mine, which the company is developing at Grand Forks, B. C. A compressor with capacity for six to eight drills and a Diesel engine have been installed. A tunnel has already been driven 100 ft. into the mountain side.

Telescope Mine Will Reopen

F. B. Sinkle and W. R. Tyler, of Mill Creek Mining, a Colorado Springs concern, have arranged to reopen the Telescope mine, at Chattanooga, Eureka district, San Juan County, Colo. Some ore, carrying silver-lead-gold, is exposed on the property on what is known as the Maude vein. It was operated in 1918 and 1919 by Telescope Mountain Mining, but has been idle since. A compressor and electric power facilities are on the ground.

Tariff Commission Studies Tungsten Mining

FIELD WORK is now under way in connection with the U. S. Tariff Commission's investigation of tungsten. This study was ordered after several requests for it had been made by the Senate. The study of the situation pertaining to ores, concentrates, and reserves will be made by Myron R. Walker, mining engineer of the staff of the commission. He will visit all of the principal tungsten mines in the country, in company with an economist and an accountant. At present the party is at Boulder, Colo., having visited the Homestake mine. Nevada, California, and Arizona will then be visited in the order named. Mr. Walker has been in close contact with tungsten mining and milling for several years. It is hoped to complete the survey within two months. The metallurgical part of the survey, to be done in the East, will be directed from Washington by F. Morton Leonard, the mining engineer in charge of the commission's mining division.

J. C. Anderson Arrested in Canario Copper Case

John Carter Anderson, of Beverly Hills, Calif., was arrested on July 25 under a federal indictment from the New York district court, accusing him of participating in the alleged Canario Copper stock fraud. Anderson posted a bond of $5,000 pending a removal hearing. He said that he had merely made a formal report on his investigation of the property of the company at Nacozari, Sonora, Mexico, and that he had not participated in the promotion of the stock. Recently all five of the individuals indicted with Cameron, Michel & Company pleaded not guilty when arraigned before Federal Justice Charles C. Cavanah.

Consolidated Mining & Smelting Exercises Option on Big Missouri Property

By H. D. Keiser
Assistant Editor

CONSOLIDATED Mining & Smelting Company of Canada exercised on July 21 its option to purchase a controlling interest in the Big Missouri property, situated 18 miles north of Stewart, British Columbia, in the Salmon River section of the Portland Canal mining district. The action follows satisfactory development of the property by the Buena Vista Mining Company, a subsidiary of Consolidated Mining & Smelting, that was organized in September, 1927, when the option was granted. A minority interest in the property, which comprises 780 acres of Crown Grant land, is retained under the terms of the option by the Big Missouri Mining Company.

Development of the property has proceeded systematically and been successful during the last six months under the management of the Buena Vista company, according to Duncan MacVichie. consul ing mining engineer, of Salt Lake City, who returned July 15 from an inspection trip of three weeks to the property, and who is managing director of the Big Missouri interests. An 1,850-ft. crosscut tunnel that developed high-grade gold-silver ore has been driven in a fractured ore zone, and over $150,000 has been expended in development work, consisting of tunneling and diamond drilling. Commercial ore was also developed in another tunnel, 600 ft. long, and in workings off a 100-ft. shaft.

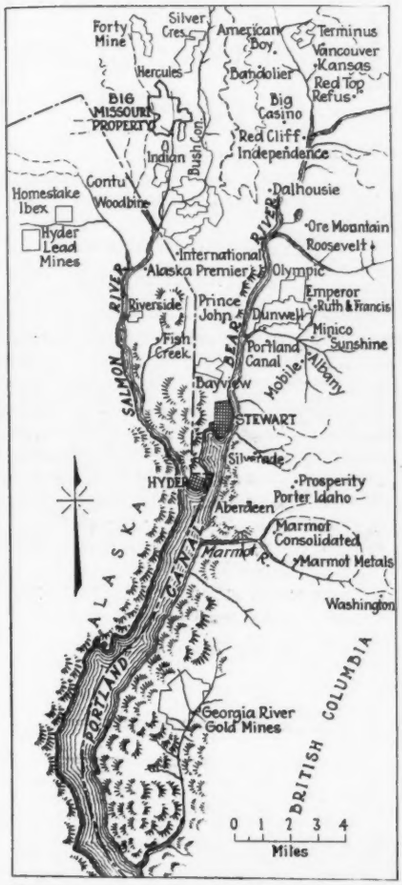
One of the outcrops on the property

Pack train bringing in supplies to the Big Missouri camp eighteen miles north of Stewart, in the Salmon River section of the Portland Canal mining district, British Columbia

A summer view of the Big Missouri camp, as seen looking across Hog Lake

At the present time a crew of twenty men is employed, and one diamond drill is being operated in the heading of the crosscut tunnel. An Ingersoll-Rand compressor, with a capacity of 300 cu.ft. per minute and driven by a marine-type Diesel engine, is in use. Development of the property is now entirely under the direction of the Consolidated Mining & Smelting management.

J. J. Warren, president of Consolidated Mining & Smelting; S. G. Blaylock, general manager; and W. M. Archibald, chief engineer, recently visited the property to inspect the development work done. Big Missouri, presumably, will be one of the groups of mining properties used by Consolidated Mining & Smelting to supplement the production from the famous Sullivan mine in treatment at the plant at Trail, B. C. Recently this company resumed the development of the George and Sibola groups, also in British Columbia.



Sketch map of the Portland Canal district, on the boundary line between British Columbia and Alaska. The Big Missouri property, recently acquired by Consolidated Mining & Smelting, is shown in the upper left-hand part of the map.

Santo Domingo Mine, in Peru, Acquired by Clarence Woods

The Santo Domingo mine, which has been owned and operated by the Inca Mining & Development Company for the last 25 years, has been acquired by Clarence Woods, manager of the Compagnie Generale de Mines en Bolivie, and associates. Mr. Woods is now in Tirapata, Peru, actively directing operations at the mine, which he hopes to bring back into the producing class at an early date. Inca Mining & Development was controlled by the late Lewis Emery, Jr., of Bradford, Pa.

American Manganese Producers to Meet at Washington

On Sept. 10 and 11, the annual meeting of the American Manganese Producers' Association will be held at the Mayflower Hotel, Washington, D. C. A review of the work of the past year and prospects for the future of the industry will be presented at this meeting. Interesting and enthusiastic sessions are anticipated. All members of the association and all persons interested in the development of American manganese are expected to be present.

Michigan College and State Survey Are Co-operating

A SERIES of conferences on the geology of the copper and iron districts of upper Michigan are being held by experts of the Michigan College of Mining and Technology and the Michigan Geological Survey. The purpose is to exchange information between the two agencies and add to the general knowledge of the copper and iron districts.

The most recent conference was held in Negaunee on the geology of the Marquette iron range. Participating were Dr. W. O. Hotchkiss, president of the Michigan College of Mining and Technology; Prof. A. E. Seaman and W. A. Seaman, assistant professor, of the department of geology of Michigan Tech; H. G. Pardee, of the Michigan Geological Survey; and Prof. C. O. Swanson, who has been in charge of a survey in the iron country for the geological survey. Similar conferences will be held at other points in the district.

The Michigan College of Mining and Technology and the Michigan Geological Survey have been co-operating in conducting extensive research in the geology of the copper and iron districts.

Prof. A. E. Seaman, who is retiring as head of the geology department of Michigan Tech, has worked in the copper and iron districts for more than 40 years and is more familiar with the geology of upper Michigan than any other geologist. The knowledge which he possesses will be of immense value in compiling geological records of great importance to the state.

Jackson-Manion Shaft Is Down to 250 Level

At the Jackson-Manion property, in the Woman Lake district of northern Ontario, the shaft has reached the 250 level. A crosscut will be driven from this point to the vein, which it is expected to encounter within 30 ft. On the 125 level, the crosscut has already reached gold ore, which averages about 10 ft. in width, according to reports received at Toronto.

Calumet & Hecla Employing 450 More Men This Year

Although production has dropped somewhat in the Michigan copper district, as is usual in the midsummer season, Calumet & Hecla has 450 more men on the payroll than a year ago at this time. This is probably one result of the extensive development program which the company has under way, particluarly in the conglomerate sections of the mine, where sinking and drifting are in progress in "A" and "C" shafts below the haulageway on the 81 level. At the Ahmeek branch, yield is around 30 lb. of refined copper per ton of ore, exclusive of mass. Through No. 2 shaft, one level is being stoped in Allouez ground. Two new levels are being driven.

Plant at Luiri Gold Should Be Finished in September

According to H. C. Hankins, secretary of Luiri Gold Areas, Ltd., which owns properties in northwestern Rhodesia, the concentrator at the mine should be finished and operating in September. Part of the machinery has already arrived at the mine and is in the course of construction. The mine is being surveyed and assay plans are to be prepared. A boiler, hoist, and headframe have been installed at the main (No. 7) shaft and preparations for starting production are well advanced. The No. 7 shaft is already down 132 ft. Two other shafts, Nos. 1 and 5, have been sunk 122 ft. and 120 ft., respectively. Crosscutting has been started on the 50 and 100 levels, and the workings already total more than 2,000 ft. in length.

Kirkland Lake Promoter Charged With Fraud

George Campbell, in charge of operations at the Campbell gold mine, in the Kirkland Lake district of northern Ontario, was arraigned before Judge Alfred Marchilden at the Montreal Police Court on July 23, on a charge of fraud in connection with the operations of the company. The complaint, which was brought by J. A. Berube, an accountant, stated that on or about Sept. 22, 1927, Campbell obtained 1,500,000 shares of stock of the Campbell mine, which was a par value of $1 a share, and a certain amount of money, not exceeding $50,000, the property of the company. Campbell entered a formal denial of the accusation and was set at liberty on parole, pending preliminary inquiry.

Lake Geneva Mining Acquires Towagmac Claims

A new company, to be known as Lake Geneva Mining Corporation, has been formed to take over the holdings of Towagmac Exploration, a Quebec company, near the Sudbury district of northern Ontario, Canada. An extensive diamond-drilling campaign was undertaken on the property, which totals 950 acres, about 40 miles from Sudbury. Flotation tests conducted at Ottawa on ore from the mine indicated that most of the zinc-lead-gold-silver content could be recovered by the use of this method. Preparations are now under way to install equipment for mining operations, and to start sinking a three-compartment shaft.

Company Organized to Work Placer Gold in Colorado

The Gold Placer Company, recently organized, will work deposits on both sides of Clear Creek in the vicinity of Empire, Colo. Rotary screens and a centrifugal amalgamator will be used to extract the metal.

London Letter

By W. A. Doman
Special Correspondent

Penpoll Smelter Will Treat Nigerian, Eastern, and Possibly Bolivian Tin

London, July 18, 1928.—As its name implies, the remodeled Penpoll smelter was originally Cornish, having been erected near Falmouth by the late Arthur Strauss. Later it was removed to Bootle (Liverpool), which is the home of the smelting industry of England, but after the death of Strauss it did not do particularly well until John Howeson, of the Anglo-Oriental Mining Corporation, came on the scene and acquired it. The plant has been remodeled and rebuilt on a new site by William Allen, and is now the most up-to-date tin smelter in this country, if not in the world. Last week the new furnaces were officially started by Lord Derby, and will operate continuously. The present capacity is 1,000 tons of tin ore per month, but the layout is such that the works can be enlarged to handle up to 6,000 tons per month.

THROUGH its associated undertakings, the Anglo-Oriental some time ago acquired control of sufficient Nigerian properties to insure the corporation an output of 50 per cent of that country's production, or more than 5,000 tons a year. A considerable production from the Eastern companies which Anglo-Oriental controls, several of which are only just getting into stride, will also be handled. It is possible, too, that it has an eye on the Bolivian ores (Antenor Patiño was present at the opening ceremony), which are smelted at Liverpool, but which have to be mixed with Nigerian or Eastern concentrates in order to allow of a proper extraction of pure tin. Most of the ore produced within the British Empire is so pure that roasting and leaching are unnecessary. The Penpoll plant, it is claimed, will give a 99.1 per cent extraction, mainly because in it is embodied the electrostatic fume precipitation process, which, energized by 100,000 volts of electric current, will save every year about 200 tons of metallic tin which would otherwise be lost in the smoke and fumes. The Williams, Harvey plant, situated near by, also recently changed hands, the late Richard Pearce's interest having been taken over by his American associates.

There is some significance in the fact that Sir Edmund Davis has joined the board of the Anglo-American Corporation. Great strides have recently been made in the prospecting and development of Northern Rhodesia, and the Anglo-American acts as technical manager of several concerns in that country. Sir Ernest Oppenheimer, is chairman of the Anglo-American.

Reference has previously been made to Rhodesian asbestos fields. Those in the Belingwe and Victoria districts belonging to the Rhodesian & General Asbestos Corporation are probably, as the owners claim, the richest in the world. The reserves of fiber on the Shabanie mine alone are 137,166 tons, and the output last year was 13,379 tons. Sales amounted to £646,932 for the twelve months, and for the first quarter of the current year to £184,740. Two other mines, the Gath's and Kings, are developing well, and, now that the properties are connected with the Rhodesian railway system, it is estimated that by 1930 sales will amount to well over £1,000,000.

Mexico City Letter

By W. L. Vail
Special Correspondent

Addition to Peñoles Smelter at Monterey, N. L., Nears Completion

Mexico City, July 21, 1928.—Work on the addition to the smelter and refinery of Peñoles Mining, the Mexican subsidiary of the American Metal Company, Ltd., at Monterey, Nuevo Leon, is nearing completion. The company has advised the Department of Commerce, Labor, and Industry that it will soon reduce the number of laborers employed in the construction by 60 per cent. The Monterey plant treats primarily Peñoles ores and bullion, but it also handles some custom business. U. H. Berthier is superintendent.

THE automobile road from Toluca to Sultepec, State of Mexico, via Zacualpam, is being constructed rapidly. A branch road will be constructed to the important mining district of Temascaltepec. This camp has been very active recently. The Lane-Rincon Mines, Inc., are employing about 400 men now, as compared with 250 a year ago. The ore is gold-silver. Blamey Stevens is general manager.

Throughout Mexico, the larger mining corporations are continuing their policy of reducing the number of employees wherever possible. There have been a few more shutdowns. San Juan Taviche Mining has been granted its application for permission to close. At the Piedra Bola mine, in the Ezatlan district, State of Jalisco, the force has been reduced to 175 men. It is operating under an agreement with Amparo Mining, whereby its production is milled at the plant of the Amparo company.

At Pachuca, Real del Monte is operating on reserve ore and, although output statistics for the camp continue to be large, the figures include production from the Achotla branch of Peñoles Mining in Guerrero.

The tragic death of President-elect Obregon, on July 17, is not expected to affect conditions in the mining districts.

Johannesburg Letter

By Owen Letcher
Special Correspondent

More Attention Given to Gold Mining Possibilities in Southern Rhodesia

Johannesburg, July 1, 1928 — For several years the number and value of new gold discoveries in Southern Rhodesia have been most unsatisfactory. In consequence a feeling of despondency has been engendered in regard to the future of gold mining in that colony. Recently, however, the policy of prospecting has been greatly changed and more attention is being paid to old mines, many of which I think were closed prematurely.

Continuation of good ore in the Globe & Phoenix mine and the Cam & Motor to depths of more than 2,000 ft.; the discovery of a new and very large orebody in the Wanderer mine; and the finding of a new and abnormally rich shoot in the Lonely Reef have been developments of first rate importance which have served to focus attention on the older mines.

IN THE Gatooma and Hartley districts, there are several properties which I believe have not been sufficiently developed. The "Three Cheers," in the Hartley district, is a large, low-grade property, with ore averaging probably not more than 4 dwt. to the ton, but it is sufficiently large to yield good profits if it is handled correctly. At the "Pickstone" the chief difficulty seems to be the metallurgical treatment. The ore contains considerable amounts of antimony, which makes it hard to handle. Application of the modern methods which have been so successfully used at the Cam & Motor should make this a profitable operation.

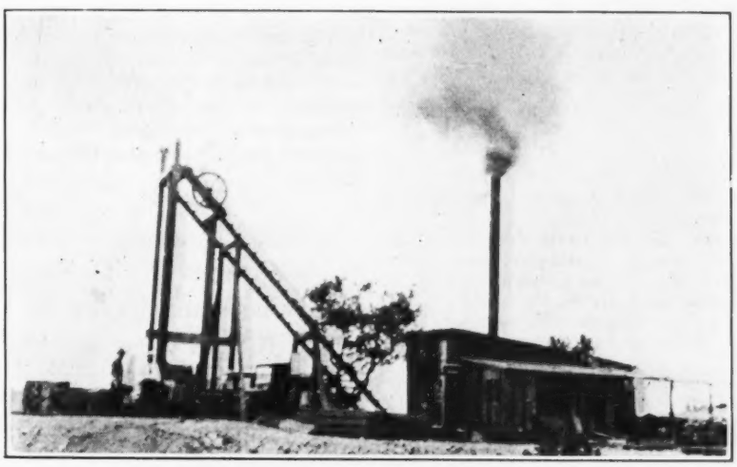
I have just returned from the Belgian Congo, where a building boom is in progress. At Panda-Likasi, Union Minière is completing a huge furnace and a flotation plant, as well as the first unit of a leaching plant, which will have an annual output of 30,000 tons of copper. It should be in commission by next July. I understand that Union Minière is forming a new subsidiary company for the manufacture of chemicals, particularly sulphuric acid, in large quantities. Much of this material will be required by the leaching plant.

Cumberland Mill Is Burned

The treatment plant of Cumberland Mines, which had been idle for some time, was burned to the ground recently, at an estimated loss of $100,000. It was situated in the La Plata district, about 20 miles northwest of Durango, Colo. Cumberland Mines owned and operated the May Day and Cumberland properties, carrying gold-silver ore.

Magna Gold, in Lander County, Nev., Increasing Scope of Operations

OPERATIONS will be expanded to a three-shift basis during August at the property of Magna Gold Mines, situated in Lander County, Nev., 45 miles southwest of Austin, according to Thomas Varley, consulting metallurgist and secretary of the company, who is directing the development of the company's holdings. During the 60 days ended July 6, hourly samples were taken of the heads and tailing at the ten-stamp Straub pilot mill used in treating the gold-quartz ore mined. Daily analyses of these samples, representative of 240 tons of mixed high- and low-grade ore milled in the period, showed that the heads averaged $8.45 and the tailing $0.80, the indicated recovery being 90.5 per cent.



Headframe at main shaft of Magna Gold Mines

Development of the property, which comprises 1,342 acres, including 160 acres of farm land, was begun by Magna Gold Mines in September, 1927, when the company was organized and acquired control of the area. From the start, all operations have been of a systematic nature and governed by thorough preliminary studies of the possibilities of the property. A 12,000-ft. east-west outcrop, varying in width from 8 to 30 ft., and dipping 80 deg. toward the north, was sampled at 200-ft. intervals by several engineers, and the average gold assay value obtained was $21.78. Subsequent tests of the ore, made at the Varley Metallurgical Laboratories, in Salt Lake City, showed that more than 90 per cent of the gold content could be extracted by amalgamation. The Straub pilot mill was then installed, and active development of the property started. A Wilfley table is now being added to the ore-dressing equipment, and, following further tests of the ore, the company plans to erect a large milling plant.

When acquired by Magna Gold Mines, the then existing development at the property consisted of three shafts—a 4x4½-ft. main shaft, 125 ft. deep, and two others, 30 and 50 ft. deep, respectively—and 150 ft. of underground workings. The main shaft has since been enlarged to a 5x8½ ft. two-compartment shaft, and extended to a depth of 200 ft. From this point 47½ ft. of crosscutting to the north was done to reach the vein, where three drifts, one 40 ft. to the west, one 32 ft. to the north, and the other 10 ft. to the east, were driven in ore. A 100-ft. drift to the southeast was also driven from the bottom of the 50-ft. shaft. According to present plans, the main shaft will eventually be extended to a depth of 600 ft., from which point a crosscut will be driven to the vein, where drifts in opposite directions will then be started in the ore. On the 200 level about 300 ft. of drifting toward the west will be done to meet, at that depth, the extension of the high-grade ore found in the bottom of the 50-ft. shaft, which is 300 ft. west of the main shaft.

Operating on a three-shift basis, twelve tons of high-grade ore will be treated daily. It is expected that this ore will have a value of $18 to $20. Mechanical equipment used includes a 168-cu.ft. Gardner vertical compressor driven by a Fordson engine, and a steam hoist at the main shaft. At the camp on the property, situated three-quarters of a mile north of the main shaft, there is a fully equipped field laboratory, besides substantial and well-furnished boarding and bunk houses. Numerous springs on the property furnish ample water for current requirements, and within a distance of three miles a supply adequate for even a 1,000-ton mill is available. Operations are in charge of H. F. Wilcox, superintendent.

Officers and directors of the company, all of whom reside in Salt Lake City, are: A. E. Athas, president; H. L. Mulliner, vice-president; George W. Reid, treasurer; Thomas Varley, secretary and consulting engineer; C. E. Athas, and R. E. Rudolph. Offices of the company are in the Continental Bank Building, Salt Lake City.

Joe Dandy Strikes Extensions of Orebodies on 400 Level

Montana-Idaho Plans Expansion to 250 Tons a Day—Basin Montana Cleaning Gray Eagle Tunnel

IN THE issue of June 9 it was stated that Butte Copper Consolidated had encountered an extension of an orebody, mined on the upper levels, on the 400 level of its Joe Dandy mine, at Radersburg, Mont. Within a radius of 40 ft. of the shaft, three of these orebodies have been opened, showing high-grade galena and lead carbonate ores. Shipments to the smelter have been made from these discoveries, and the returns showed about 35 per cent zinc and 7 oz. of silver to the ton. About 18 tons a day is being shipped. The company is now installing a 70 hp. electrically driven Ottumwa hoist with a rope speed of 400 ft. per minute. To take care of this installation and future installation of a plunger pump, three General Electric transformers have been acquired.

At present, Montana-Idaho Mines is treating 140 tons a day at its cyanide mill at Unionville, 4 miles south of Helena, Mont. The orebodies at the mine are being developed under the supervision of Homer Emerson, formerly superintendent of the Bertha mine, at Corbin, Mont. Construction has been started to increase mill capacity to 250 tons a day. It is believed that this work will be finished within the next six weeks.

The company recently sunk the main shaft at is East Pacific property, in Broadwater County, from the seventh to the eighth level. Lead-gold-silver ore was encountered about 60 ft. north and 30 ft. west of the shaft. Operations at the Kleinschmidt property of the same company are on a small scale.

A group of claims in the southwest portion of the Butte district has been acquired by J. Gavan, H. C. Rogers, and R. E. Tower. Anna Butte Mining has been formed, with a capitalization of 500,000 shares at a par value of $1. A two-compartment shaft will be sunk close to the Butte-Southern and Ardsley groups.

Basin Montana Tunnel reports good progress in cleaning out the lower tunnel on its Gray Eagle property, Jefferson County, Mont. It is believed that the tunnel will tap the Comet vein within a few weeks. As soon as this work is finished, the company expects to start its long tunnel to crosscut the known veins lying between the Gray Eagle and the Great Northern Railroad. This tunnel will probably be three miles long. Besides this work, the company has a crew of men on work at the Lillie B. claim, where ore carrying copper and silver has been uncovered about 3,300 ft. from the portal of the proposed tunnel.

Societies, Addresses, Reports

A.I.M.E. Cancels Visit to Nova Scotia and Newfoundland in September

SUBSEQUENT to the printing of that portion of this issue of the *E. & M. J.* containing editorial mention of the proposed visit of the American Institute of Mining and Metallurgical Engineers to Nova Scotia and Newfoundland, circumstances arose making it advisable to cancel the plans. The excursion, that was to have started from Boston immediately after the technical sessions during the last three days of August, will not be made.

The official headquarters of the Boston meeting will be the Copley-Plaza Hotel. It will be held under the auspices of the Boston section and the committee on geophysical methods of prospecting. One of the more notable features of the meeting will be an exhibition of geophysical instruments and methods at the Massachusetts Institute of Technology. The program follows:

WEDNESDAY, AUGUST 29

10 a.m.—Registration at the Copley-Plaza Hotel.
11 a.m.—Opening session with formal addresses of welcome and replies.
2 p.m.—Opening of geophysical exhibit at Massachusetts Institute of Technology, with visits to Tech and Harvard, followed by a tour of Old Boston.
8 p.m.—First technical session at the Copley-Plaza. Separate entertainment for women.
10 p.m.—Buffet supper at University Club.

THURSDAY, AUGUST 30

10 a.m.—Technical session at the Copley-Plaza.
2 p.m.—Continuation of technical session. An excursion will be arranged for the women, including lunch and bridge at one of the country clubs.
7:45 p.m.—Subscription dinner at the Copley-Plaza, followed by brief speeches and dancing.

FRIDAY, AUGUST 31

An all-day excursion for both men and women is being arranged.

Committees for the Boston meeting are as follows:

General Committee—G. H. Clevenger, chairman; F. W. Paine, L. C. Graton, C. F. Moore, W. Spencer Hutchinson, Robert Livermore.

Women's Committee—Mrs. Carle R. Hayward, Mrs. E. E. Bugbee, Mrs. G. H. Clevenger, Mrs. W. H. Coburn, Mrs. W. S. Hutchinson, Mrs. G. A. Packard.

Geophysical Exhibit—W. Spencer Hutchinson, Edward E. Bugbee, Charles E. Locke.

Program—Members of the Committee on Geophysical Methods of Prospecting, A. C. Lane, acting chairman for D. H. McLaughlin.

George Otis Smith Speaks Before Columbia Section

"THE West is the storehouse of the nation's mineral and power wealth," Dr. George Otis Smith, president of the A.I.M.E. and director of the U. S. Geological Survey, said in an address before the Columbia section of the Institute at Spokane on July 20. The meeting, which was held at the Davenport Hotel, was presided over by F. Cushing Moore, chairman of the section, and was attended by a large number of engineers.

Dr. Smith declared that the resources of the West are the engineer's problem. "He is the fact finder, and it is he who must also teach industry how to use these facts," he said. Politics has not kept pace with the advancement in industry. Our cities are still governed by the same old machine, although industry has adopted new machines. The engineer, who is responsible for the machines in industry, is needed in politics, he declared, intimating there is a prospect that this will be fulfilled at the election this year.

A speech was also delivered by Dr. F. J. Kelly, president of the University of Idaho. He spoke of the university's desire to aid the mineral and other industries of the state and expressed the belief that in technical courses there is need that greater attention be paid to the fundamentals.

Non-Ferrous Ingot Metal Institute Is Formed

THE Non-Ferrous Ingot Metal Institute came into being at a meeting held at Atlantic City on July 20, at which most of the principal producers of the non-ferrous ingot metals ratified a constitution and bylaws and elected officers and members of the executive committee.

The first officers of the institute are: President, Benjamin Harris, of Benjamin Harris & Company; vice-president, I. Glouck, of the Federated Metals Corporation; treasurer, L. Chapman, of H. Kramer & Company; members of executive committee, William Lewin, Lewin Metals Corporation, and W. J. Coane, Ajax Metal Company. R. D. T. Hollowell, experienced in trade organization work and at present secretary-treasurer of the American Face Brick Association, will soon assume the management of the institute. The headquarters of the institute will be in Chicago.

"It is the ideal of the members of the institute," said Mr. Harris, "to develop policies which will be of constructive benefit both to the industry and the consuming public. It will be our purpose to build slowly and soundly, drawing freely upon the best in modern, conservative thought to determine the institute's objectives. With this policy in view, the initial activity will be to make a survey of the problems of both the manufacturers and consumers. Not until this survey has been completed will the institute attempt to determine which of the many possible activities it will pursue. We will undoubtedly undertake, sooner or later, extensive technical researches into the problems of manufacture and utility of non-ferrous ingot metals, commercial researches to determine how we may better serve our present customers and locate new fields for development, the adoption and promotion of the use of high standards of quality and specifications, the encouragement of sound business practices, voluntarily aiding in the prevention of unfair competition and trade abuses, and the promotion of intelligent business management on a basis of wholesome competition."

San Francisco Section Welcomes T. T. Read, Assistant Secretary

ON JULY 19, the San Francisco section of the A.I.M.E. gave a luncheon to Dr. T. T. Read, Assistant Secretary, at the Engineers Club. Dr. Read had the opportunity of renewing many old acquaintances, as he formerly lived in San Francisco while affiliated with *Mining & Scientic Press*. Twenty-four members sat down for the luncheon, which was held in the cheerful rear dining room of the Engineers Club—where the windows look out over San Francisco Bay, Goat Island, and the Ferry Building. Berkeley and Oakland are easily visible on the other side of the bay. E. A. Hersam, chairman of the San Francisco section, introduced Dr. Read to the members assembled, and he in turn spoke at some length pertaining to various problems affecting the A.I.M.E., at present composed of about 9,000 members.

Hoover Awarded Medal for Flood Relief Work

In recognition of his "great public service from the standpoint of human values," and particularly for "his conspicuous work in the Mississippi flood relief," Herbert Hoover has been awarded the Major Surgeon Louis Livingston Seaman medal by the American Museum of Safety. The medal, as expressed by its donor, Major Seaman, is for "the best record in the saving of life in the field of sanitation and accidents."

Personal Notes

S. E. STEIN is making a short trip through the gold districts of northern Ontario and Quebec.

J. A. F. DUROCHER-STONE, who recently purchased a large group of mines in the Cripple Creek district of Colorado, is visiting the district.

FRANK M. SMITH, smelter director of Bunker Hill & Sullivan Mining & Concentrating Company, with headquarters at Spokane, Wash., is in New York.

W. W. SCHWARTZ has recently accepted a position with Pickands, Mather & Company at Hibbing, Mich. Mr. Schwartz is a graduate of the University of Idaho.

HAROLD C. RICKABY, who has been engaged in research work at the University of Toronto, has been appointed assistant geologist of the Ontario Department of Mines.

R. D. GEORGE, state geologist of Colorado, will make a trip through various Colorado mining districts for the purpose of testing a new instrument for electrical prospecting.

W. H. CORBOULD, of the Mount Isa Company, Queensland, Australia, lately visited the Edie Creek gold fields in New Guinea, and, on his return to Australia, left for London.

Dr. WILLARD ROUSE JILLSON, State Geologist of Kentucky, was reappointed director of the Kentucky Geological Survey on July 11, 1928, for a term of four years by Governor F. D. Sampson.

DR. FRANCIS THOMSON, the new president of the Montana State School of Mines, was given a reception recently by the Montana Society of Engineers and the Montana section of the A.I.M.E.

L. O. GOODMAN was re-elected president and director of Ardsley Butte Mines and R. E. SAWYER was re-elected manager and director at the recent meeting of the company, held in Butte.

H. J. EVANS, superintendent of the Cia. Minera Nazareno y Catasillas at Salaverna, State of Zacatecas, Mexico, is visiting the Southern and Eastern parts of the United States during his vacation.

SIR THOMAS TAIT, who is interested in the salt industry, recently visited the deposits at Malagash, in Pictou County, N. S., where his investigations are regarded as possible indications of developments on a large scale.

C. H. WHITTUM, of Rawlins, Wyo., was in Wallace, Idaho, recently, inspecting the mill under construction for Dickens Consolidated, of which he is president. It is expected that the new plant will be in operation on Oct. 1.

LEWIS A. LEVENSALER, who represents the American Smelting & Refining Company at Seattle, has been in New York conferring with officials of the company in the general offices.

DR. ROBERT J. ANDERSON, vice-president in charge of production of the Fairmont Manufacturing Company,

R. J. ANDERSON

Fairmont, W. Va., manufacturers of rolled aluminum products, sailed from New York on Aug. 1 for an extended business trip abroad.

F. L. RANSOME, professor of geology at the California Institute of Technology, Pasadena, Calif., recently completed a brief examination of the Simon silver-lead mine, near Mina, Nev. He left immediately thereafter for Sonora and Chihuahua, Mexico.

J. W. THOMPSON, flotation engineer of General Engineering, returned to the Salt Lake City offices of the company on July 26 from six months' stay in Arizona. He will leave soon to undertake work at the plant of the Century Zinc Company, situated in the Oklahoma section of the Tri-State district.

JAMES A. SMITH, S. T. PAUL, and JOHN STIMAC, of the Tramway mine of Anaconda Copper, were recently awarded silver medals by the company for removing a man from the trolley wire on the 1,700 level and saving his life by means of artificial respiration. JOHN L. BOARDMAN, head of the safety bureau of the company, made the awards.

DR. N. B. LEWIS, a graduate of the Melbourne University, Australia, who has been studying at Oxford University for two years, arrived in Melbourne from London lately. Dr. Lewis will take part in the geophysical survey under the direction of BROUGHTON EDGE, which will experiment with geophysical methods in Australia.

DR. ANDREW C. LAWSON, for 38 years instructor in geology at the University of California, retired on July 25 from active work. He will assume the title of emeritus professor of geology and mineralogy. Although born in Scotland, Dr. Lawson received his training at the University of Toronto, at Toronto, Ontario, Canada. He has been a member of the faculty of the university at Berkeley since 1890.

CARL DAVIS, technical director of Anglo-American Corporation of South Africa, has just completed an extensive trip through the mining districts of South Africa. He inspected, among others, the Bwana M'Kubwa, N'Kana, N'Changa, Roan Antelope, and other copper properties in northern Rhodesia in which his company is interested. He also visited the new electrolytic zinc plant which has just gone into operation at Rhodesia Broken Hill. After leaving Broken Hill, Mr. Davis proceeded to Johannesburg, and, after inspecting developments on the Rand, departed for the diamond fields near Luderitzbucht, owned by Consolidated Diamond Mines. He also visited the new diamond fields at Namaqualand in which the Anglo-American Corporation has acquired an interest.

OBITUARY

WILLIAM EVANS GUY, retired mining and civil engineer, died at Cooperstown, N. Y., on July 24. He was 84 years old.

DAVID T. ADAMS, one of the pioneers on the Mesabi Range, died in Chicago on July 22. He was 66 years old. Mr. Adams, among a number of other discoveries, found the mine on the Mesabi which now bears his name.

JOHN J. QUILL, who had operated plants at various mines in western Nevada, died on July 22 at Reno, following an extended illness. He was 66 years old. Mr. Quill is survived by a daughter, three sisters, and a brother.

GORDON G. HARGRAFT, mining engineer, of Toronto, died in New York on July 23. Mr. Hargraft was a member of Hargraft Brothers, a mining engineering firm in Toronto. He served as a lieutenant in the Canadian Expeditionary Forces during the World War.

JOHN PHILIP FLYNN, of Bronxville, N. Y., a prominent mining man, died in Toronto on July 27, at the age of 74. He was born in Elburn, Ill., and during the earlier part of his career was engaged in mining and railway construction in the United States and Mexico. He went to northern Ontario in the early days of the Cobalt boom, and was one of the pioneers in the Porcupine field, where he became interested in many enterprises, including the Vipond and McIntyre-Porcupine Mines. Later he devoted his attention to the Sudbury mining area, where he had considerable holdings. He is survived by three sons and two daughters.

MARKET AND FINANCIAL NEWS

Canada Produced More Lead in 1927

PRODUCTION of lead in Canada in 1927, as shown by the finally revised statistics of the Dominion Bureau of Statistics, establishes the fact that a new production record in quantity was made when the total recovery amounted to 311,423,161 lb., worth $16,477,139, against 283,801,265 lb., valued at $19,240,661, in 1926.

The greater part of Canada's production was from the Trail smelter, which received a large proportion of its lead ores from the Sullivan mine, at Kimberley, B. C. The remainder of Canada's production comprised pig-lead produced at Galetta, Ontario, lead from lead ores and concentrates shipped from the Mayo district of the Yukon Territory and from the Tetreault mine in Portneuf County, Quebec.

Production, Imports and Exports of Lead in Canada

	1926		1927	
Production—by provinces	Pounds	Value	Pounds	Value
Quebec	3,729,636	$251,788	6,496,577	$341,461
Ontario	7,398,795	580,730	7,990,709	528,729
British Columbia	266,812,461	18,012,509	292,770,544	15,388,020
Yukon	860,373	395,634	4,165,331	218,929
Totals	283,801,265	$19,240,661	311,423,161	$16,477,139
Imports				
Old and scrap, pig and block	766,939	$67,671	405,127	$33,165
Bars and sheets	116,846	11,887	112,039	8,906
Litharge	2,229,600	223,839	3,015,000	245,630
Acetate and nitrate of lead	140,046	13,492	337,044	28,218
Other manufactures	.....	263,398	.....	344,053
Pipe lead	116,344	11,011	109,296	8,456
Shots and bullets	12,316	1,543	14,129	1,514
Tea lead	83,531	10,362	59,808	5,936
Lead pigments—				
Dry white lead	60,606	5,539	338,399	24,879
White lead, ground in oil	73,468	7,539	360,301	28,252
Dry red lead and orange mineral	1,158,873	112,915	1,844,288	125,358
Totals	.....	$729,196	.....	$854,367
Exports				
Lead, contained in ore	13,644,900	$796,412	13,032,600	$844,637
Pig lead	202,510,300	12,983,907	239,409,100	11,981,388
Totals	216,155,200	$13,780,319	252,441,700	$12,826,025

Canadian Zinc Production Increased in 1927

PRODUCTION of zinc in Canada for 1927, according to finally revised statistics, as reported by the Dominion Bureau of Statistics, indicates that a new high record for quantity was established, but because of lower prices the total value of the output was less than in 1926. The 1927 production amounted to 165,495,525 lb., which, when valued at the average London price for the year of 6.194c. per pound, was worth $10,250,793. The 1926 output of 149,938,105 lb., valued at the average London price for the year of 7.41c. per pound, was worth $11,110,413.

Canada's zinc production includes the zinc produced by the Consolidated Mining & Smelting Company, Ltd., of Tadanac, B. C., from the ores of the Sullivan, and other mines of the east and west Kootenay districts; and the recoverable zinc in ores exported, both from British Columbia and from the Tetreault silver-lead-zinc properties in Quebec. Though no other provinces reported a production in 1927, large developments are under way on zinc properties in the Sudbury district, near Chelmsford, Ontario, on the copper-zinc deposits of northwestern Manitoba and in northwestern Quebec.

Production, Imports and Exports of Zinc in Canada

	1926		1927	
Production—by provinces	Pounds	Value	Pounds	Value
Quebec	12,904,176	$956,199	17,189,046	$1,064,690
British Columbia	137,033,929	10,154,214	148,306,479	9,186,103
Totals	149,938,105	$11,110,413	165,495,525	$10,250,793
Imports				
Zinc dust	476,440	$51,543	339,055	$34,110
Zinc in blocks, pigs and sheets	5,756,282	578,041	5,911,727	512,389
Zinc in slabs	1,122,640	86,779	1,355,816	89,233
Zinc white (80 per cent zinc)	13,278,306	943,724	16,665,713	1,113,573
Zinc sulphate and chloride of (44 per cent zinc)	1,655,245	73,721	2,032,015	86,149
Zinc manufactures, n.o.p.	.....	156,637	.....	277,236
Totals	.....	$1,890,445	.....	$2,112,690
Exports				
Zinc ore, tons	41,917	$1,393,165	25,227	$862,498
Zinc spelter, lb.	96,008,100	7,107,876	112,420,400	6,826,808
Totals	.....	$8,501,041	.....	$7,689,306

STATISTICAL NOTES

ALASKA JUNEAU GOLD MINING COMPANY estimates the results of its operations for June, 1928, as follows:

Receipts		Cents per Ton
Gold	$263,000	88.02
Lead and silver	6,500	2.18
Total	$269,500	90.20
Operating Expenditures		
Mining and tramming	$95,000	31.79
Milling	70,000	23.43
All other Juneau operating costs	6,900	2.31
New York stock transfer and San Francisco office expenses	3,600	1.20
Total	$175,500	58.73
Operating profit	$94,000	31.47
Other Expenditures and Accrued Charges		
Ebner mining property and other outside prospecting	$3,000	.....
Interest on indebtedness	14,500	.....
Total	$17,500	.....
Surplus	$76,500	.....

Material mined and trammed to mill amounted to 298,000 tons.

FEDERAL MINING & SMELTING COMPANY reports net earnings, before depletion, depreciation, taxes, or construction expenditures, of $551,931 during the quarter ended April 30, 1928. This compares with net earnings of $550,937 in the period ended Jan. 31, 1928, and $870,688 for the quarter ended April 30, 1927.

FREEPORT TEXAS COMPANY, sulphur producer, reports net income of $1,271,431 during the half year ended May 31, 1928. This compares with net income of $1,599,589 in the six months' period ended May 31, 1928. Sulphur production for the first six months of 1928 was 16 per cent higher than in the first six months of 1927.

MOND NICKEL COMPANY, LTD., reports gross profit of £770,090 during the year ended April 30, 1928. Assets of the company on that date totaled £8,134,343, which figure includes the value of the company's mining properties in Canada and refining works in England. Dividends announced for distribution Aug. 1, 1928, amount to £311,250.

TRANSVAAL GOLD PRODUCTION for May was 886,186 oz., according to the Chamber of Mines of South Africa, valued at £3,764,279. These figures surpass the previous record, that of March, 1928, by 8,806 oz., equal in value to £37,406. The native labor returns show 198,461 "boys" working on May 31 in the Witwatersrand gold mines, which is a reduction in numbers of 1,359 from the record for April 30.

Metal Statistics

Monthly Average Prices of Metals

Silver

	New York		London Spot		Sterling Exchange	
	1927	1928	1927	1928	1927	1928
January	55.795	57.135	25.863	26.313	484.775	487.098
February	57.898	57.016	26.854	26.205	484.551	487.008
March	55.506	57.245	25.655	26.329	484.887	487.558
April	56.399	57.395	26.136	26.409	485.178	487.785
May	56.280	60.298	26.072	27.654	485.288	487.685
June	56.769	60.019	26.203	27.459	485.183	487.565
July	56.360	59.215	25.983	27.262	485.145	485.923
August	54.718	.....	25.224	.....	485.546	.....
September	55.445	.....	25.565	.....	485.878	.....
October	56.035	.....	25.776	.....	486.533	.....
November	57.474	.....	26.526	.....	486.956	.....
December	57.957	.....	26.701	.....	487.714	.....
Year	56.370	.....	26.047	.....	485.636	.....

New York quotations, cents per ounce troy, 999 fine. London, pence per ounce, sterling silver, 925 fine.

Copper

	New York		London Spot			
	Electrolytic		Standard		Electrolytic	
	1927	1928	1927	1928	1927	1928
January	12.990	13.854	55.414	61.912	62.375	66.575
February	12.682	13.823	54.438	61.670	61.119	66.381
March	13.079	13.845	55.935	61.148	62.641	66.443
April	12.808	13.986	55.056	61.678	61.526	66.500
May	12.621	14.203	54.563	62.554	60.881	67.216
June	12.370	14.527	54.030	63.664	59.881	68 738
July	12.532	14.527	54.551	62.881	60.089	68.670
August	12.971	.....	55.364	.....	62.227	.....
September	12.940	.....	54.455	.....	61.830	.....
October	12.958	.....	55.119	.....	62.256	.....
November	13.319	.....	58.830	.....	63.761	.....
December	13.774	.....	60.078	.....	66.181	.....
Year	12.920	.....	55.653	.....	62.064	.....

New York quotations, cents per pound. London, pounds sterling per long ton.

Lead

	New York		St. Louis		London			
	1927	1928	1927	1928	1927 Spot	1927 3 Mos.	1928 Spot	1928 3 Mos.
January	7.577	6.500	7.392	6.280	27.485	27.786	21.773	22.213
February	7.420	6.329	7.286	6.069	27.344	27.781	20.283	20.747
March	7.577	6.000	7.328	5.805	27.845	28.302	19.938	20.352
April	7.126	6.100	6.807	5.991	26.546	27.053	20.306	20.563
May	6.616	6.123	6.269	6.012	25.054	25.526	20.483	20.813
June	6.414	6.300	6.150	6.152	24.438	24.750	20.985	21.211
July	6.344	6.220	6.120	6.038	23.491	23.932	20.602	20.957
August	6.681	.....	6.367	.....	23.119	23.540	.....	.....
September	6.297	.....	6.044	.....	21.446	21.994	.....	.....
October	6.250	.....	6.013	.....	20.479	20.946	.....	.....
November	6.259	.....	6.035	.....	20.889	21.318	.....	.....
December	6.504	.....	6.319	.....	22.163	22.441	.....	.....
Year	6.755	.....	6.511	.....	24.192	24.614	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Tin

	New York				London	
	1927	1928	1927	1928	1927	1928
	99%		Straits		Spot	
January	64.785	55.180	66.415	55.650	297.804	253.222
February	66.528	51.793	69.142	52.440	306.125	233.833
March	67.833	51.630	69.199	52.220	313.315	232.722
April	66.069	.....	67.933	52.270	302.572	234.204
May	63.935	.....	67.510	51.582	294.938	230.886
June	64.226	.....	67.466	47.938	296.006	217.280
July	62.625	.....	64.110	47.040	288.690	212.449
August	63.523	.....	64.431	.....	293.193	.....
September	60.735	.....	61.490	.....	280.432	.....
October	57.560	.....	58.450	.....	264.631	.....
November	57.089	.....	57.641	.....	262.591	.....
December	58.053	.....	58.452	.....	267.138	.....
Year	62.747	.....	64.353	.....	288.953	.....

New York quotations, cents per pound. Quotations on 99 per cent tin discontinued on April 1, because of absence of business. London, pounds sterling per long ton.

Zinc

	St. Louis		London			
	1927	1928	1927 Spot	1927 3 Mos.	1928 Spot	1928 3 Mos.
January	6.661	5.643	30.979	30.938	26.125	26.051
February	6.673	5.551	29.931	30.109	25.518	25.506
March	6.692	5.624	30.649	30.889	25.082	24.960
April	6.338	5.759	29.579	29.901	25.493	25.316
May	6.075	6.026	29.034	29.131	26.102	25.756
June	6.213	6.158	28.598	28.613	25.664	25.429
July	6.229	6.201	28.280	28.021	24.946	24.972
August	6.342	.....	28.210	28.068	.....	.....
September	6.212	.....	27.347	27.327	.....	.....
October	5.996	.....	26.899	26.634	.....	.....
November	5.745	.....	26.281	26.006	.....	.....
December	5.722	.....	26.363	26.109	.....	.....
Year	6.242	.....	28.513	28.479	.....	.....

St. Louis quotations, cents per pound. London pounds sterling per long ton

Antimony, Quicksilver and Platinum

	Antimony (a)		Quicksilver (b)		Platinum (c)			
	New York		New York		Refined		Crude	
	1927	1928	1927	1928	1927	1928	1927	1928
Jan	13.910	10.863	101.200	123.620	109.520	79.280	99.820	69.280
Feb	14.509	10.842	101.727	121.370	107.545	84.783	99.295	74.783
March	12.801	10.083	110.259	122.557	108.000	80.000	100.426	70.000
April	14.166	9.865	123.250	123.740	101.885	80.000	91.865	70.000
May	12.975	11.019	123.900	123.173	84.680	78.000	75.000	68.000
June	12.447	9.750	118.096	122.423	72.000	78.000	62.500	68.000
July	11.880	9.540	119.880	121.260	72.000	78.000	61.520	68.000
Aug	11.826	.....	119.111	.....	72.000	.....	62.000	.....
Sept	11.073	.....	119.640	.....	72.000	.....	62.000	.....
Oct	11.165	.....	126.200	.....	72.000	.....	62.000	.....
Nov	10.763	.....	127.708	.....	72.000	.....	62.000	.....
Dec	11.195	.....	126.933	.....	72.000	.....	62.000	.....
Year	12.393	.....	118.159	.....	84.636	.....	75.036	.....

(a) Antimony quotations in cents per pound, for ordinary brands. (b) Quicksilver in dollars per flask of 76 lb. Prior to June, 1927, the unit had been the 75-lb. flask. (c) Platinum in dollars per ounce.

Pig Iron, Valley[1], and Aluminum 98 Per Cent

	Bessemer		Basic		No. 2 Foundry		Aluminum	
	1927	1928	1927	1928	1927	1928	1927	1928
Jan	19.50	17.50	18.16	17.00	18.50	17.25	26.270	24.300
Feb	19.02	17.50	18.00	17.00	18.50	17.25	26.000	24.300
March	19.37	17.50	18.28	17.00	18.50	17.25	26.000	24.300
April	19.50	17.50	19.00	17.00	18.50	17.24	26.000	24.300
May	19.24	17.37	18.24	16.38	18.50	16.79	26.000	24.300
June	18.96	17.00	17.96	15.56	18.35	16.79	26.000	24.300
July	18.50	17.00	17.50	15.75	18.00	16.69	26.000	24.300
Aug	18.50	.....	17.32	.....	17.65	.....	26.000	.....
Sept	18.00	.....	17.11	.....	17.50	.....	26.000	.....
Oct	18.00	.....	17.00	.....	17.50	.....	25.600	.....
Nov	18.00	.....	17.00	.....	17.47	.....	25.000	.....
Dec	17.69	.....	17.00	.....	17.25	.....	24.785	.....
Year	18.69	.....	17.71	.....	18.02	.....	25.808	.....

Iron in dollars per long ton. Aluminum in cents per pound, 98 per cent grade.

[1]F.o.b. Mahoning and Shenango valley furnaces; freight to Pittsburgh, $1.76.

Monthly Crude Copper Output in Short Tons

	1928					
	Jan.	Feb.	Mar.	April	May	June
Domestic						
Alaska shipments	2,084	908	3,495	2,084	1,767	2,351
Butte & Superior	.....	.....	†205	.....	.....	†128
Calumet & Arizona	2,066	2,041	2,019	2,102	2,726	1,991
Magma	1,300	1,398	1,346	1,525	1,451	1,593
Miami	1,963	1,955	2,029	2,092	2,185	2,055
New Cornelia	3,672	3,267	3,318	3,224	2,924	3,050
Nevada Con	.....	.....	†26,288	.....	.....	.....
Old Dominion*	996	992	1,009	988	1,010	882
Phelps Dodge††	8,273	7,331	7,803	8,334	8,083	8,887
United Verde Extension	1,633	1,624	1,699	1,604	1,724	1,670
Utah Copper	.....	.....	†27,810	.....	.....	.....
Tennessee Copper	510	514	596	526	582	527
Foreign						
Braden	8,502	8,504	8,504	8,506	9,544	.....
Boleo, Mexico	1,068	1,262	1,130	1,012	953	882
Bwana M'Kubwa	677	600	533	392	556	.....
Chile	8,146	8,119	7,854	8,155	8,787	.....
Furukawa, Japan	1,548	1,563	1,677	1,559	1,285	.....
Granby Cons., Canada	2,305	2,155	2,326	2,406	2,505	.....
Mount Lyell, Australia	.....	.....	†1,510	.....	.....	.....
Sumitomo, Japan	1,317	1,381	1,316	1,483	1,475	.....
Union Miniere, Africa	10,359	9,590	10,689	10,780	10,689	10,120

†Three months. *Includes Arizona Commercial
††Moctezuma is included.

Monthly Production of Primary Copper from U. S. Mines and Daily Rate (Short Tons)

	1926		1927		1928	
	Monthly Production	Daily Rate	Monthly Production	Daily Rate	Monthly Production	Daily Rate
January	71,026	2,291	76,198	2,458	68,469	2,21
February	68,131	2,433	69,202	2,472	67,423	2,32
March	75,728	2,443	69,314	2,236	70,327	2,26
April	73,454	2,448	71,122	2,371	69,230	2,30
May	73,542	2,372	71,613	2,310	73,729	2,37
June	71,317	2,377	69,539	2,318	70,954	2,365
July	72,228	2,330	65,545	2,114	.....	.....
August	72,014	2,323	67,248	2,169	.....	.....
September	72,672	2,421	65,936	2,198	.....	.....
October	75,099	2,423	68,595	2,225	.....	.....
November	74,947	2,498	68,080	2,269	.....	.....
December	72,205	2,329	67,377	2,173	.....	.....
Total	872,509	.....	829,878	.....	420,623	.....
Monthly average	72,709	.....	69,165	.....	70,104	.....
Average of daily rate	.....	2,390	.....	2,274	.....	2,311

The Market Report

Copper and Zinc Buying Improved—Prices Stable

New York, Aug. 1, 1928—Whereas, last week, lead was perhaps the most active of the non-ferrous metals, copper and zinc have now displaced it in interest. Total sales of zinc reported bulk the largest for many weeks, though the market has not been considered active. Copper has been in good midsummer demand. Lead and tin have both been quiet, as has silver. The prices of all of the major metals are unchanged, except for the slightest variations from last week.

Better Demand for Copper

Copper buying has not been up to the rate of production in the last week, but nevertheless it has been considerably better than it was in the week before, and perfectly satisfactory to the sellers, who would rather play golf than sell copper right now anyway. Manufacturers have done better so far this year than they expected to, and a good fall business is in prospect. Not much of this has yet been placed, however, so a good tonnage of September copper is likely to be booked during August. The situation bears no resemblance, however, to the hand-to-mouth conditions that prevailed in the late winter. Wire business has, perhaps, been a little disappointing lately, but brass has stood up well, considering the season. Copper prices are unchanged at 14¾c., delivered in the East, and 14⅞c. in the Middle West, with the usual concessions to points near the refineries. Export prices continue at 15c., c.i.f.

Foreign sales in the month just closed were well over those in the domestic market, being about 38,000 tons, compared with 25,000 tons, or thereabouts, in the United States. Domestic sales were almost twice as large in July of last year, but consumers were in a more under-bought condition at that time, in their cruel effort to depress the price below 12½c.

Correction—London standard copper as of July 11 was incorrectly cabled and published. On that day, the correct quotation for spot standard was 63 1/16 and for three months', 63 5/16.

Lead Buying in Smaller Volume

Following several weeks of fair activity, the lead market has entered into a period of unusual dullness. Sellers report the lessening of interest shown by consumers as not unexpected, claiming that sales earlier in July were well above the normal rate for the month. Business for the greater part has been provided by sales in carload lots to small consumers in various industries, and desilverized lead has been

Average Metal Prices for July, 1928

COPPER:	
New York Electrolytic	14.527
London Standard Spot	62.881
London Electrolytic Spot	68.670
LEAD:	
New York	6.220
St. Louis	6.038
London Spot	20.602
London Forward	20.957
SILVER:	
New York	59.215
London	27.262
Sterling Exchange	485.923
ZINC:	
St. Louis	6.201
London Spot	24.946
London Forward	24.972
TIN:	
Straits	47.040
London	212.449
QUICKSILVER	121.260
ANTIMONY	9.540
PLATINUM:	
Refined	78.000
Crude	68.000
ALUMINUM 99 PER CENT PLUS.	24.300

Daily Prices of Metals

July Aug.	Electrolytic Copper	Straits Tin	Lead		Zinc
	Refinery	New York	New York	St. Louis	St. Louis
26	14.525	48.375	6.20	6.00	6.20
27	14.525	48.000	6.20	6.00	6.20
28	14.525	48.000	6.20	6.00	6.20
30	14.525	47.875	6.20	6.00	6.20
31	14.525	47.750	6.20	6.00	6.20
1	14.525@14.55	48.00@48.25	6.20	6.00	6.20
	14.527	48.021	6.200	6.000	6.200

Average prices for calendar week ending July 28, 1928, are: Copper, 14.525; Straits tin, 48.104; N. Y. lead, 6.200; St. Louis lead, 6.000; zinc, 6.204; and silver, 59.625.

The above quotations are our appraisal of the major markets for domestic consumption based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

Copper, lead, and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

In the trade, copper prices usually are quoted on a delivered basis; that is, delivered at consumer's plant. As delivery and interest charges vary with the destination, the figures shown above are net prices at refineries on the Atlantic seaboard. Delivered prices in New England average 0.225c. per pound above those quoted, and prices at so-called Middle West destinations, 0.325c. above.

Quotations for copper are for the ordinary form of wire bars and ingot bars. For ingots an extra 0.05c. per pound is charged; for slabs, 0.075c.; and for cakes, 0.125c. up, depending on weight. Cathodes are sold at a discount of 0.125c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York is now quoted at 0.35c. per pound above St. Louis, this being the freight rate between the two points.

Quotations for lead reflect prices obtained for common lead, and do not include grades on which a premium is asked.

London

July Aug.	Copper			Tin		Lead		Zinc	
	Standard		Electrolytic	Spot	3M	Spot	3M	Spot	3M
	Spot	3M							
26	62 3/4	63 1/8	68 3/4	220 7/8	218 1/4	20 15/16	21 3/16	24 3/4	24 7/8
27	62 11/16	63 1/16	68 3/4	216 1/2	214 3/4	20 15/16	21 1/8	24 7/8	24 7/8
30	62 11/16	63 1/8	68 3/4	214 1/2	213	21	21 1/8	25 1/16	24 7/8
31	62 11/16	63 1/8	68 3/4	214	213 1/4	20 15/16	21 1/8	25	24 7/8
1	62 1/2	63	68 3/4	215 1/4	213 3/4	20 7/8	21 3/16	24 9/16	24 7/8

The above table gives the closing quotations on the London Metal Exchange. All prices in pounds sterling per ton of 2,240 lb.

Silver, Gold, and Sterling Exchange

July	Sterling Exchange "Checks"	Silver		Gold London	July Aug.	Sterling Exchange "Checks"	Silver		Gold London
		New York	London				New York	London	
26	4.85 1/4	59 3/4	27 7/16	84s11 1/2d	30	4.85 3/8	59 1/4	27 5/16	84s11 1/2d
27	4.85 3/8	59 7/8	27 1/2	84s11 1/2d	31	4.85 1/4	59 3/8	27 5/16	84s11 1/2d
28	4.85 3/8	59 1/2	27 3/8	.....	1	4.85 1/4	59 1/4	27 1/4	84s11 1/2d

Ave. 59.500

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London silver quotations are in pence per troy ounce of sterling silver, 925 fine. Sterling quotations represent the demand market in the forenoon. Cables command three-eighths cent premium.

specified in most transactions. Demand for chemical lead in the East St. Louis market has been light. Producers appear satisfied to entertain a temporary let-up in buying, and profess to be contented with the present condition of the market. London has been firm, with quotations for spot lead showing a small net advance during the week ending today. No change of consequence has occurred in the statistical position of the metal.

Zinc Still 6.20c.

Though the total volume of zinc purchases has been excellent, there were not many small orders in the market. Sellers have been quoting prompt at 6.20c., East St. Louis, and 6.25c. for August and September, hoping that buyers would not notice when the end of the month came around, but they could not get away with this, and now 6.20c. rules for August. Galvanizers are still thought to be under-bought.

Tin Slightly Easier

The London tin market continues bullish, and, though consumer buying in the domestic market has been light, for hand-to-mouth requirements, the New York price has been well maintained in sympathy with the strength exhibited in London. A slight easing in price has been noted during the week ending today, and the backwardation in three months' Straits tin has been reduced from £3 to about £1½ in London during the week. Increase in tin stocks available for immediate delivery is reported to be the major factor in this movement.

Silver Closes at 59¼c.

Silver prices eased off slightly during the week, caused by sales abroad for China account. India has given some support at the lower level and the market closes quiet and steady.

Mexican Dollars (Old Mexican pesos): July 26th, 45⅜c; 27th, 45½c.; 28th, 45⅛c.; 30th, 44⅞c.; 31st, 45c.; Aug. 1st, 44⅞c.

Foreign Exchange

Sterling continues easier, with Canadian dollars advancing to new high levels. Closing cable quotations on Tuesday, July 31, were as follows: Francs, 3.91$\frac{13}{32}$; lire, 5.23⅜; marks, 23.87½. Canadian dollars, ⅛ per cent premium.

Blende Shipment Increased—Galena in More Demand

Joplin, Mo., July 28, 1928

Blende		Per Ton
High		$41.80
Premium blende, basis 60 per cent zinc	$40.00@	41.00
Prime Western, basis 60 per cent zinc		40.00
Fines and slimes, 60 per cent zinc	37.00@	39.00
Average settling price, all zinc		39.50
Galena		
High		82.20
Basis 80 per cent lead		80.00
Average settling price, all lead		81.82

Shipments for the week: Blende, 13,156; lead, 1,692 tons. Value, all ores the week, $658,130.

The shipment of blende was increased 775 tons over last week, and was more than 30 per cent above the reported purchases of 9,840 tons. Shipments continue to reduce the reserve stocks, exceeding production this week by 720 tons. Shipments of galena from reserve stocks of owners who have repeatedly remarked that $80 basis would buy no lead from them indicate that some sort of arrangement prevails equivalent to offering a premium over the quoted price.

Platteville, Wis., July 28, 1928

Zinc Blende	Per Ton
Blende, basis 60 per cent	$42.75
Lead Ore	
Lead, basis 80 per cent	$81.00

Shipments for the week: Blende, 916 tons; lead, none. Shipments for the year: Blende, 21,434 tons; lead, 1,245 tons. Shipments for the week to separating plants, 1,557 tons blende.

Record Steel Production So Far This Year

Pittsburgh, July 31, 1928

July production of steel was well above the average for that month, even though it was the lowest for the year. The seasonal decrease has been unusually mild, steel-ingot production in July being between 70 and 75 per cent of capacity, against 76 per cent in June and an average of 84 per cent for the half year. The June increase of 220,187 tons in the Steel Corporation's unfilled obligations, when June has usually shown a decrease, presaged an unusually good July operation.

Steel-company earnings show material increases from the first to the second quarter, when the tonnage of shipments was substantially identical. There were slightly higher invoice prices, representing partial success of the efforts that mills initiated around the first of the year to raise the market.

So far this year steel-ingot production is above the record high by about 3 per cent. A seasonal increase is expected in August or September, but there is no visible sign as yet, among the steel-consuming industries, of such a turn. Automobile production usually increases in August.

Bars, shapes, and plates were put under contract for the current quarter at 1.85c., Pittsburgh, and mills are endeavoring to stiffen the current market to 1.90c. minimum. Their recent announcement of 2.00c. for fourth quarter has not been taken seriously by buyers.

Pig Iron—The Valley pig-iron market was quiet throughout July. Bessemer held at $17, basic was nominal at $15.75, and foundry dropped from $16.75 to a range of $16.50@$16.75; freight to Pittsburgh, $1.76.

Connellsville Coke—The market has been dull, remaining at $2.65@$2.75 for furnace and $3.75@$4.25 for foundry.

Other Metals

Quotations cover large wholesale lots, f.o.b. New York, unless otherwise specified. London prices are according to latest mail advices.

ALUMINUM—Per lb., 99 per cent plus grades, price of leading interest, 24.30c. Outside market, 99 per cent plus, 24.30c.; 98-99 per cent, 23.90c. London, 98 per cent, quoted at £95 per long ton for domestic consumption.

ANTIMONY—Per lb., duty paid: Chinese brands, near-by, 10c., futures, 10¼c. Market strong. Cookson's "C" grade, spot, 15⅜c. Chinese needle, lump, 8c. Standard powdered needle, 200 mesh, 10c. Nominal.

BISMUTH—Per lb., in ton lots, $1.70. Smaller lots $1.85 and up. London 7s. 6d.

CADMIUM—Per lb., 70@75c. Active demand. London, 2s. 4d.@2s. 6d. for Australian metal.

COBALT—Per lb., f.o.b. Canadian works: Shot, 96@98 per cent, $2.50@$3. Black oxide, 70 per cent, $2.10. London, 10s. for metal; 8s. for black oxide; 8s. 10d. for gray.

[1]GERMANIUM OXIDE—Per gram in 300- to 500-gram lots, $5.

IRIDIUM—Per oz., $280@$300 for 98 @99 per cent sponge and powder. Market nominal. London, £57@£60.

[1]LITHIUM—Per oz., 98@99 per cent grade in 1- to 5-lb. lots, $5.

MAGNESIUM—Per lb., in ton lots, single orders for spot metal: 8-lb. ingots (3x3x16 in.), 98c.; 3-lb. sticks (1⅛x33 in.), $0.95@$1; 10-oz. sticks (1x12 in.), 85@90c. Discounts up to 20 per cent on larger orders or contracts. Market active. London 4s.@4s. 3d. for 99 per cent ingots or sticks.

[1]MOLYBDENUM—Per gram, 99 per cent, 4c. (Usually sold as calcium molybdate or ferromolybdenum, which see).

NICKEL—Per lb., ingot, 35c.; shot, 36c.: electrolytic, 37c. (99.90 per cent grade), for single lots of spot metal. London, per long ton, £170@£175 according to quantity.

OSMIUM—Per oz., $55@$65; London, £12@£14.

PALLADIUM — Per oz., $42@$47. Large offerings reported as having a bearish effect on the market, at least temporarily. London £10¼@£11½. Nominal.

PLATINUM—Official price quoted by the leading interest on small miscellaneous orders for refined metal, per oz., $78. Dealers and refiners quote the trade for refined metal, per oz., cash, for wholesale lots, $74@$74.50 bid, $76@$76.50 asked. Market quiet.

London, per oz., £16 10s.@£17 for refined; crude and scrap, nominal at £15 10s.@£15 15s.

QUICKSILVER — Per 76-lb. flask, $120@$122. Nominal. San Francisco wires $122.33. London easy at £21 7s. 6d.@£21 10s., with spot metal available at a discount of 3 per cent.

RADIUM — Per mg. radium content, $70.

[1]Price furnished by Foote Mineral Co., Philadelphia.

RHODIUM—Per oz., $40@$55. Nominal.

RUTHENIUM — Per oz., $35@$55. Nominal.

[1]SELENIUM — Per lb. in ton lots: Black, powdered, amorphous, 99.5 per cent pure, $2.25. London, 7s. 8d.@ 7s. 9d.

TANTALUM — Per gram: Bar and heavy sheet, chemically pure, 20c.; tantalum powder, 11c.

TELLURIUM—Per oz., 15@18c.

[1]THALLIUM METAL—Per oz.: Ingot, 99 per cent pure, $1.06 in 25-lb. lots.

TUNGSTEN POWDER—Containing 97 to 98 per cent tungsten, per lb., 96 to 98c., depending on quantity. Market nominal.

[1]ZIRCONIUM METAL—Per oz., 98 per cent grade, $1.56 in 5- to 10-lb. lots.

Metallic Ores

CHROME ORE—Per long ton, f.o.b. Eastern shipping points, Indian and Rhodesian ores, $22@$23.50 for 47 to 50 per cent Cr_2O_3 ore. Prices firm.

IRON ORE—Per long ton, lower Lake ports. Lake Superior ores.

Mesabi, non-bessemer, 51½ per cent iron, $4.25. Old Range, $4.40.

Mesabi, bessemer, 51½ per cent iron, $4.40. Old Range, bessemer, 51½ per cent, $4.55.

Eastern ores, cents per unit, delivered at furnaces: Foundry and basic, 58 to 63 per cent, 8@8½c.

Foreign ores, f.o.b. cars Atlantic ports, cents per unit:

North African, low-phosphorus, 10 @11c., nominal.

Spanish foundry or basic, 50@60 per cent, 8½@10c. Nominal.

Swedish foundry or basic, 66@68 per cent, 9@9½c. Nominal.

MANGANESE ORE—Per long ton unit of Mn, c.i.f. North Atlantic ports. Exclusive of duty. Brazilian and Indian ores, minimum 47 per cent Mn, 35@38c. Caucasian (washed), 52@55 per cent, 38@40c.

Per ton in carload lots:

[1]Chemical grades, powdered, coarse or fine, 82@87 per cent MnO_2, Brazilian and Cuban, $70@$80. Caucasian, minimum 85 per cent, $70. Montana, 70 to 75 per cent, $70@$80. Domestic, 70 to 72 per cent, $40@$50.

TANTALUM ORE—Per unit of combined Ta_2O_5 and Cb_2O_5, basis 65 per cent ore, $30.

TITANIUM ORE—Ilmenite, per gross ton, 52 to 60 per cent TiO_2, f.o.b. Atlantic seaboard, $9.50@$11, according to grade and impurities. Low-grade domestic, 32 to 35 per cent, about $7@$8 per gross ton. Rutile, per lb., 93 per cent concentrate, 10c. for 30-ton lots.

TUNGSTEN ORE—Per unit of WO_3, N. Y.: Wolframite, $10.75@$11. Western scheelite, $10.75@$11. Market quieter after period of activity.

ZIRCON ORE—Per net ton containing 55 per cent ZrO_2, f.o.b. Atlantic seaboard, $8 in 30-ton lots.

Non-Metallic Minerals

Prices received for non-metallic minerals vary widely and depend upon the physical and chemical characteristics of the commodity. Hence the following quotations can serve only as a general guide to the prices obtained by producers and dealers in different parts of the United States for their own product. In the last analysis the value of a particular non-metallic mineral can be ascertained only by direct negotiation between buyer and seller.

[1]AMBLYGONITE—Per ton, f.o.b. mines: 8@9 per cent lithium oxide, $50@$60.

ASBESTOS—Per ton: f.o.b. Quebec mines, tax and bags included, prices quoted by leading interest:

Crude No. 1, $600@$650; crude No. 2, $375@$400; spinning fibers, $190@ $225; magnesia and compressed sheet fibers, $160@$175; shingle stock, $55@ $115, various grades; paper stock, $45@ $50; cement stock, $25; short fibers, $10@$20; floats, $15. Market firm, demand good.

Per ton c.i.f. New York: Rhodesian crude No. 1, $450; No. 2, $350.

BARYTES—Per ton: f.o.b. mines, bags extra:

Georgia: Barytes ore, crude (per long ton), $7. Washed and water floated to 97 per cent through 300 mesh, $19. Shipments continue at fair rate.

Missouri: Water ground and floated, bleached, $23; $25 in less than car lots, f.o.b. works. Crude ore, 93 per cent $BaSO_4$, not to exceed 1 per cent iron, $6.50@$7.50, f.o.b. mines. Market steady.

BAUXITE—Per long ton: Domestic ore, chemical, crushed and dried, 55 to 58 per cent Al_2O_3, 1.5 to 2.5 per cent Fe_2O_3, $7.50@$8, f.o.b. *Georgia* mines. Other grades, 56 to 59 per cent Al_2O_3, 5 to 8 per cent SiO_2, $7.50@$8.50 f.o.b. *Georgia-Alabama* mines. Pulverized and dried, $14; calcined, 78 to 84 per cent Al_2O_3, $18@$20.

Per metric ton, foreign, c.i.f. Atlantic port: Dalmatian, 50 to 55 per cent Al_2O_3, 1 to 3 per cent SiO_2, $4.80@ $6.50; Istrian, 54 to 57 per cent Al_2O_3, 3 to 5 per cent SiO_2, $5.50@$7; French, 56 to 59 per cent Al_2O_3, 2 to 5 per cent SiO_2, $6@$8.

BORAX—Per lb.: Carload lots, in bags, crystals, 2¾c.; granulated or powdered, 2½c.; f.o.b. consumers' shipping point.

[1]CELESTITE—Per ton in carload lots: 90 per cent $SrSO_4$, finely powdered, $27.

CHALK—Per ton: Crude in bulk, c.i.f. *New York,* $4.75@$5.

CHINA CLAY (KAOLIN)—Per ton: F.o.b. *Virginia* mines, crude lump, No. 1, $7; crude No. 2, $5.50; washed, $8; powdered and air-floated, $10@$15; ground, $7@$10.

Florida, pressed pottery, bulk, $13.50; ground, No. 1, $20; No. 2, $15. Sprayed mineral flour, No. 1, $20; No. 2, $17. Market slow.

Best grade, domestic, $16@$18, f.o.b. *Delaware* plants in carload lots.

Imported English, f.o.b. American ports: Lump, $13@$21; powdered, $45@$50.

DIATOMITE — Per short ton, f.o.b. plant:

Kiln-fired brick, $65; kiln-fired aggregate, ¼ in., $45; insulating powder $25; natural aggregate, ¼ in., $18@$20; air-floated powder, $45. Over 85 per cent silica, 98 per cent through 200 mesh, $25@$26, depending on quantity.

EMERY — F.o.b. *Pennsylvania* and *New York* in 350-lb. kegs, per lb.: Greek Naxos, 6½c.; Turkish, 6½c.; Khasia, 5½c.; domestic, 3½c. Market good.

FELDSPAR—F.o.b. mine or grinding plant:

North Carolina, per long ton, No. 1 pottery grade, crude, $5.50@$7.50; glass grades, $5@$6. Market good.

New Hampshire, per ton: Pottery grade, $8. Best quality lump, $9.

New York, Per ton: f.o.b. cars, No. 1 crude, $9. Market quiet.

Tennessee, per ton: No. 1, pottery, 140 mesh, $16; 200 mesh, $18. No. 2, enamel, 20 mesh, $10.25; 90 mesh, $12; 140 mesh, $13.75; 200 mesh, $15.50. No. 3, 20 mesh, $9. Market fair.

Maine, per ton: Best pottery grade, ground, $19. Market slow.

FLUORSPAR—Per ton: F.o.b. *Kentucky* and *Illinois* mines.

Gravel, not less than 85 per cent CaF_2, and not over 5 per cent SiO_2, $17. Foundry lump, 85-5, $18. Ground 95 to 98 per cent CaF_2, and not over 2½ per cent SiO_2, $32.50 in bulk; $36.50 in bags or barrels. Acid lump, 98-1, $30 in car lots. Market quiet.

New Mexico: 85-5 gravel, $16.50; 85-5 lump, $16.50; 94-3 lump, $21; 97-2 sacked, $30. Market fair.

Foreign spar, duty paid, $15.50@$17, tidewater.

FULLER'S EARTH — Per ton, f.o.b. *Florida:* 16 to 30 mesh, $16.50; 30 to 60 mesh, $18; 60 to 100 mesh, $14; 100 mesh up, $8; 200 mesh up, $14.

Powdered, import duty paid, $24@ $25 per ton.

GARNET — Per ton; domestic, f.o.b. mines, $85.

Spanish grades, $60, c.i.f. port of entry.

GILSONITE — Per ton, carload lots f.o.b. mines *Colorado:*

Selected grade, $33; seconds (mine run), $25.50. Normal market.

GRAPHITE—Per lb.: F.o.b. *New York.* Ceylon lump, 8@8½c.; chip, 7@7½c.; dust, 3@5c.; Madagascar flake, 7@7½c.

No. 1 flake, 10c. and up. No. 2 flake, 7c. and up. Foundry facings, 3c. and up. Amorphous and crystalline, fine ground, 3c. and up.

Crude amorphous graphite, $15@$35 per ton, according to grade.

GREENSAND—Per ton, f.o.b. cars, *New Jersey:* Screened and bagged, best grade in carload lots, $25. Market seasonally quiet.

[1]Price furnished by Foote Mineral Co., Philadelphia.

GYPSUM—Per ton, f.o.b. mill, depending upon location: Crushed, $1.70@$3; ground, $4@$9; agricultural, $4@$9; calcined, $6@$13.

IRON OXIDE (See Ocher)—Per lb.: Standard Spanish red, 3@4½c.; domestic earth, 2@4½c.

KAOLIN—See China Clay.

[1]LEPIDOLITE—Per ton: $20@$30 for ordinary grades. Nominal.

LIMESTONE—Per ton: f.o.b. shipping points, depending on location, either lump or crushed, 25c.@$3.

Agricultural, $1 up to $6 for crushed or pulverized. Prices depend upon source, purity, and fineness.

MAGNESITE — Per short ton, f.o.b. *California* mines: Grade "A" calcined, 80 per cent through 200 mesh, $42; Grade B, $37.50; dead burned, $28, crude, $11. F.o.b. Eastern seaboard, calcined, $40.

MICA—Per ton, f. o.b. plant:

New Hampshire: Mine run, $320; clean shop scrap, $25; mine scrap, $22.40. White dry ground, 20 mesh, $25; 40 mesh, $35; 60 mesh, $55; 100 mesh, $75; 200 mesh, $80. Market improving.

North Carolina: White, ground, 20 mesh, $35; 70 mesh, $100.

Madagascar, amber, per lb., f.o.b. *New York*, duty paid: No. A1, $2.50; No. 1, $2; No. 2, $1.65; No. 3, $1.15; No. 4, 60c.; No. 5, 45c. Market slow.

[1]MONAZITE—Per ton: (Minimum 6 per cent ThO_2), $130.

OCHER — F.o.b. *Georgia* mines, per ton: $19@$20 in sacks; $21@$22 in barrels; washed and water floated, $18; second grade, 99 per cent through 225 mesh, $18. Market good.

PHOSPHATE—Per long ton, f.a.s. or f.o.b. mines:

Florida, pebble, f.a.s., for export: 76@77 per cent, $7; 75 per cent, $6.25; 74@75 per cent, $6; 70 per cent, $4.50; 68 per cent, $4.10; 66 per cent, $4. Prices firm.

Florida, pebble, domestic: 76@77 per cent, $6.50; 74@75 per cent, $5.50; 72 per cent, $4.50; 70 per cent, $4. Market dull during summer months.

Tennessee, ground, 90 per cent through 200 mesh, 33 per cent P_2O_5, $11.70 per short ton. Brown lump for acid manufacture, per gross ton, $6 on 75 per cent basis; $5.25 on 72 per cent basis. Non-acidulated, fine ground, 65 per cent, $8 (per short ton).

POTASH—The ruling contract prices are as follows:

	Bags	Bulk
Muriate of potash 80 @ 85 per cent, basis 80 per cent....	36.40	34.80
Sulphate of potash 90 @ 95 per cent, basis 90 per cent....	47.30	45.70
Sulphate of potash-magnesia 48 @ 53 per cent, basis 48 per cent	27.25	25.65
Manure salt 30 per cent.....	21.75	18.75
Manure salt 20 per cent.....	15.40	12.40
Kainit 14 @ 16 per cent.....	12.50	9.50
Kainit 12.4 per cent.....	12.00	9.00

Two thousand pounds net weight, c.i.f. Atlantic and Gulf ports. German weights, tares and analyses.

PUMICE STONE—Per lb.: In barrels, powdered, 2½@4c.; selected lump, 5@7c.

PYRITES—Per long ton unit of sulphur: C.i.f. United States ports; guaranteed 48 per cent sulphur, Spanish, 13c.; Tharsis, furnace size, 2½ in. diameter, 14c. Cinder from ore to remain property of buyers.

[1]QUARTZ ROCK CRYSTALS—Per lb. in ton lots: Colorless, clear but flawed, pieces ¼ to ½ lb. in weight, 40c. For optical purposes, double above prices; larger crystals still higher.

SILICA—Per ton: Water ground and floated, in bags, f.o.b. Illinois: 400 mesh, $31; 350 mesh, $26; 250 mesh, $18. Market fair. Glass sand, f.o.b. producing plant, 75c.@$5 per ton; molding sand, 65c.@$3.50; blast sand, $1.35@$3.50.

[1]SPODUMENE — Per ton: $20@$30, depending upon lithium content. Nominal.

SULPHUR—Per ton for domestic market, $18, f.o.b. Texas mines; $22 for export, Atlantic ports. Prices in reality are on a c.i.f. basis, but the average price reduced to an f.a.s. figure is about as given. Open prices $1 higher than above.

TALC—Per ton, carload lots, f.o.b. works, containers included:

Vermont: 99 per cent through 200 mesh, extra white, $9.50@$10; 96½ to 98 per cent through 200 mesh, medium white, $8.50@$9.50; packed in 50-lb. paper bags; prices $1 per ton less in burlap sacks. Market weak.

New York: Double air-floated, 200 mesh, $13.75; 325 mesh, $14.75. Market good.

Georgia: Powdered, gray, $7.50@$10; yellow, $9@$12; red, $11@$13; roofing, $7.50@$9.

New Jersey: Soapstone, ground, $10@$12.

TRIPOLI—Per short ton, burlap bags, paper liners, minimum carload 30 tons, f.o.b. *Missouri:* Once ground through 40 mesh; rose and cream colored, $14. Double ground through 110 mesh; rose and cream, $17. Air-floated through 200 mesh, rose and cream. $25: mill run, $15. Demand unusually active at present.

Metallic Compounds

ANTIMONY OXIDE—White, Chinese, 99 per cent Sb_2O_3, 15½c. per lb.

ARSENIOUS OXIDE (White arsenic)—Per lb., 4c. Delivered near by. Market firm. London, per long ton, £17@£17¼ quoted for Cornish white.

CALCIUM MOLYBDATE OR MOLYTE — Per lb. of contained Mo, 95c.@$1, delivered.

COPPER SULPHATE (Blue Vitriol)—Per lb. in car lots, 5.30@5.40c., for either large or small crystals.

SODIUM NITRATE—Per 100 lb.; crude. in bags ex vessel, Atlantic ports, $2.15 for spot; future delivery, $2.17½@$2.22½.

SODIUM SULPHATE (Salt Cake)—Per ton, bulk, f.o.b. works, $10@$17.

[1]Price furnished by Foote Mineral Co., Philadelphia.

ZINC OXIDE—Per lb. in bags, in car lots: Lead-free, 6½c.; 10, 20 or 35 per cent leaded grades, 6⅝c.; French red seal, in bags, 9⅜c.

Alloys

[1]FERROCERIUM—Per lb., $9 in 15 to 75 lb. lots.

FERROCHROME—Per lb. of contained chromium, 60@70 per cent chromium, 4 to 6 per cent carbon, 11c. Spot shipments slightly higher. Freight allowed in carload lots east of Mississippi River and north of Baltimore. Market active.

FERROMANGANESE — Per gross ton furnace: Domestic and foreign, 78@82 per cent, $105 for last half of 1928. Spiegeleisen, 19@21 per cent, $33 on carload business, f.o.b. furnace.

FERROMOLYBDENUM—Per lb. of Mo, f.o.b. shipping point, 50@60 per cent Mo, $1.25.

FERROPHOSPHORUS—Per ton, 18 per cent P, $91; electrolytic, 24 per cent, $122.50; f.o.b. *Alabama* and *Tennessee*.

FERROSILICON—Per gross ton, f.o.b. works, freight allowed on carload lots east of Mississippi River and north of Baltimore: 50 per cent, $83.50; 75 per cent, $140; 14@17 per cent, $45, f.o.b. Suspension Bridge, N. Y. Quotations for spot shipments slightly higher. Market active.

FERROCARBONTITANIUM — Per ton: For 15 to 18 per cent material, $200, f.o.b. Niagara Falls, N. Y.

FERROTUNGSTEN—Per lb. of W contained, 75@80 per cent W, 96@98c., f.o.b. works. Market unchanged.

FERROVANADIUM—Per lb. of V contained, f.o.b. works, $3.15@$3.65, depending on grade and quantity. Market active.

MONEL METAL—Per lb. base price for shot, 28c., f.o.b. Huntington, W. Va.

NICKEL SILVER—29¾c. per lb. for 18 per cent nickel Grade A sheets.

YELLOW (MUNTZ) METAL—Dimension sheets, 20¼c. per lb.; rods, 17¼c. per lb.

Rolled Metals

COPPER—Sheets, 23½c.; wire, 16⅝c. per lb., f.o.b. mill.

LEAD SHEETS—Full rolled, 10c. per lb.; clipped, 10¼c.

ZINC SHEETS—Price advanced from 9¼ to 9¾c. per lb., effective July 30, f.o.b. works.

Refractories

CHROME BRICK—Per net ton, f.o.b. shipping point, $45.

FIRECLAY BRICK — Per M.: First quality, $43@$46, *Ohio, Kentucky, Central Pennsylvania;* second quality, $35@$38.

MAGNESITE BRICK—Per net ton, f.o.b. works: 9-in. straights, $65.

SILICA BRICK—Per M., *Pennsylvania* and *Ohio*, $43; *Alabama*, $51; *Illinois*, $52.

[1]ZIRKITE—Per lb.: Powdered, 80 per cent ZrO_2, 3½c. Brick, straights, 80c.@$1 each.

Mining Stocks—Week Ended July 28, 1928

Stock	Exch.	High	Low	Last		Last Div.
COPPER						
Anaconda	New York	68	66	67⅜	Jl.14, Au. 20 Q	1.00
Ariz. Com'l	Boston	4½	4	4½	Jl. 16, Jl. 31 SA	0.25
Cal. & Ariz	New York	98⅞	95½	97	Je. 8, Je. 25 Q	1.50
Calumet & Hecla	Boston	23	22	22⅝	Au. 31, Se. 15 Q	0.50
Cerro de Pasco	New York	76½	74	75⅜	Jl.12, Au. 1 Q	1.25
Chile Copper	New York	46⅝	44½	44½	Se.15 Se.29 Q	0.62½
Con. Coppermines	N. Y. Curb	10⅛	9⅛	10⅛		
Copper Range	Boston	18⅜	17⅛	18⅛	Mr. 24, Ap. 20 A	1.00
Crystal Copper	Boston Curb	*35	*32	*32		
East Butte	Boston	2⅜	2⅛	2⅜	Dec., 1919	0.50
Granby Consol	New York	54⅜	52⅛	53¼	Jl.13, Au.1 Q	1.00
Greene Cananea	New York	103⅜	98	102	Se. 14, Oc.1 Q	1.00
Howe Sound	New York	58⅛	56⅛	57⅜	Je.30, Jl.16, Q	1.00
Inspiration Consol	New York	22⅛	21⅛	21⅞	Apr. 1927 Q	0.25
Isle Royale	Boston	19⅝	17⅞	19⅛	Au.31, Se.15 SAX	0.75
Kennecott	New York	95⅛	93⅜	94⅛	Jl. 1, Jl. 2 Q	1.25
Magma Copper	New York	51⅛	49⅝	51⅜	Jl.29, Jl.16 Q	0.75
Mason Valley	N. Y. Curb	1⅛	1⅛	1⅛		
Miami Copper	New York	20⅛	20	20⅛	Au.1, Au.15, Q	0.37½
Mohawk	Boston	59	57	58⅛	Jl. 31, Se. 1 Q	1.00
Montana-Idaho	Spokane	*21	*16½	*17⅜		
Mother Lode Coal	New York	2⅜	2½	2⅜	Je.8, Je. 30, SA	0.15
Nevada Consol	New York	23	22	22⅜	Je.15, Je.30 Q	0.375
New Cornelia	Boston	29	28	28½	Au.3, Au. 20 Q	0.50
Noranda	N. Y. Curb	58⅜	55	55		
North Butte	Boston	3½	3	3½	Oct., 1918	0.25
Ohio Copper	N. Y. Curb	*80	*71	*71	Sept., 1926	0.03
Old Dominion	Boston	16	15	15⅜	Dec., 1918	1.00
Phelps Dodge	N. Y. Curb	133½	133	133½	Je.25, Jl.22 Q	2.00
Quincy	Boston	40	38	39	March, 1920	1.00
St. Mary's Min. Ld	Boston	29	27	29	Ap.1928 A	2.00
Seneca Copper	New York	2½	2½	2½		
Shattuck-Denn	N. Y. Curb	15	14⅛	15		
Tenn. C. & C	New York	14	13½	14	My.29, Je.15,Q	0.12½
United Verde Ex	N. Y. Curb	16⅛	15⅛	16¼	July 6, Q	0.50
Utah Copper	New York	160	160	160	Je.15, Je.30 Q	1.50
Utah Metal & T	Boston	1⅛	1 3/16	1⅛	Dec., 1917	0.30
Walker Mining	Salt Lake	1.32½	1.25	1.32½		
NICKEL-COPPER						
Internat. Nickel	New York	97⅛	91	96	Je.14, Je.30 Q	0.50
Internat. Nickel pfd	New York	116	116	116	Jl.12, Au.1 Q	1.50
LEAD						
Gladstone Mtn	Spokane	*3½	*2½	*2½	June, 1927	0.005
National Lead	New York	123	118⅞	123	Se.14, Se.29 Q	1.25
National Lead, pfd. A	New York	124½	124½	124½	Au.31, Se.15 Q	1.75
National Lead, pfd. B	New York	...	...	122	Oc. 19, No.1 Q	1.50
St. Joseph Lead	New York	41	40	41	Je.9, Je.20, QX	0.75
ZINC						
Am. Z. L. & S	New York	27⅜	24⅜	27	May, 1917	1.00
Am. Z. L. & S. pfd	New York	87½	83	87½	Nov., 1920	1.50
Butte C. & Z	New York	7	6⅛	7	De., 1926	0.50
Butte & Superior	New York	11⅛	11	11⅛	Je.15,Je.30 Q	0.50
Callahan Zn-Ld	New York	3	2⅜	2⅜	De., 1920	0.50
Consol.Lead&Zinc 'A'	St. Louis	13½	13	13	Je.25, Jl.1 Q	0.25
Eagle-Picher	Cincinnati	17¼	17	17⅛	No.15, De.1 Q	0.40
Eagle-Picher pfd	Cincinnati	...	...	100	Mr. 31, Ap. 16 Q	1.50
New Jersey Zn	N. Y. Curb	225	215	221	Jl. 20, Au. 10 X	2.00
Treadwell-Yukon	Toronto	18.25	17.80	18.05		
United Zinc	N. Y. Curb	...	...	*70		
Yellow Pine	Los Angeles	*25	*25	*25	Dec., 1925 QX	0.04
GOLD						
Alaska Juneau	New York	4⅛	3⅜	3⅜		
Ankerite	Toronto	...	...	*40		
Barry-Hollinger	Toronto	*58	*44	*46		
Central Manitoba	Toronto	1.05	*75	*83		
Cresson Consol.	N. Y. Curb	1⅛	1	1	Je.30, Jl.10 Q	0.10
Dome Mines	New York	8½	8⅛	8⅛	Je.30, Jl.20 Q	0.25
Golden Cycle	Colo.Springs	†1.68	†1.66½	...	My. 31, Je.10 Q	0.04
Gold Hill	Toronto	*9	*7	*8½		
Hollinger Consol	Toronto	11.75	10.50	10.75	Jl.25, Au.11 MO	0.10
Homestake Mining	New York	74	74	74	Jl.20, Jl.25 M	0.50
Kirkland Lake	Toronto	1.58	1.48	1.55		
Lake Shore	Toronto	21.90	21.15	21.60	Je.1, Je.15 QX	0.20
McIntyre Porcupine	New York	22¼	22	22¼	Au.1, Se.1 Q	0.25
Portland	Colo.Springs	†*20	†*17½	...	Ap., 1927	0.02
Rand Mines	New York	...	...	39½	Fe.21-28 Am.Sh.	1.52
Sylvanite	Toronto	2.15	2.00	2.02		
Teck-Hughes	Toronto	9.85	9.25	9.40	Jl. 17, Au. 1 SAX	0.15
Tom Reed	Los Angeles	*42	*41	*41	Dec., 1926	0.02
Tough-Oakes	Toronto	*23½	*19½	*23½		
Vipond Cons	Toronto	*48	*44	*46	April, 1927	0.03
Wright-Hargreaves	Toronto	3.25	3.00	3.08	Jl.16, Au.1 Q	0.02½
GOLD AND SILVER						
Carnegie Metals	N. Y. Curb	18⅛	18⅛	18⅛		
Con. Cortez	N. Y. Curb	*21	*21	*21		
Dolores Esperanza	N. Y. Curb	1 1/16	*91	*95	July, 1923	0.05
N.Y. Hond's Rosario	N. Y. Curb	...	...	15	Jl.18, Jl.28 Q	0.50
Premier Gold	N. Y. Curb	2⅜	2⅛	2⅛	Je.14, Jl.3	0.06
Tonopah Belmont	N. Y. Curb	1	1	1	Oc., 1925	0.05
Tonopah Extension	N. Y. Curb	*13	*13	*13	Ap., 1925	0.05
Tonopah Mining	N. Y. Curb	5	4⅛	4⅛	Mar.31,Ap.21 SA	0.07½
West End Consol	N. Y. Curb	...	...	*5	Mar., 1923	0.05
Yukon Gold	Boston Curb	*74	*67	*70	June, 1918	0.02
SILVER						
Beaver Consol	Toronto	*93	*87½	*87½	May, 1920	0.03
Castle-Trethewey	Toronto	*54½	*48	*54		
Coniagas	Toronto	4.80	4.80	4.80	May, 1924	0.12½
Keeley	Toronto	*56	*50	*51½	Mr.1, Mr.15 SA	0.04
Lorrain Trout Lake	Toronto	...	...	*50	July, 1925	0.05
Mining Corp. Can	Toronto	3.50	3.29	3.40	My.20, Je.13 SA	0.125
Nipissing	N. Y. Curb	3¼	3⅛	3⅛	Je.30, Jl.20Q	0.075

Stock	Exch.	High	Low	Last		Last Div.
SILVER-LEAD						
Ahumada	New York	3⅛	3	3⅛	Ap., 1927	0.12½
Bingham Mines	Boston	45	43	45	Je.23, Jl.5 Q	1.00
Bunker Hill & Sullivan	N. Y. Curb	136	136	136	Je.30, Jl.5 QX	0.75
Cardiff M. & M	Salt Lake	*61	*60	*60	Feb. 5, 1927	0.10
Consti'nMng.&Mill'g	Spokane	*30	*26	*30		
Erupcion	Boston Curb	*28	*28	*28	Dec. 13, Jan. 3,	0.07½
Eureka Lily	Salt Lake	2.15	2.05	2.05		
Federal M. & S	New York	...	...	125	Je., 1927	10.00
Federal M. & S. pfd	New York	98	98	98	My.25, Je.15 Q	1.75
Hecla Mining	N. Y. Curb	15⅛	14⅞	15⅛	My.15, Je.15 Q	0.15
Highland-Surprise	Spokane	*12	*11	*11⅛		
Iron King Mining	Salt Lake	*70	*70	*70		
Keystone Mining	Salt Lake	†*30	†*20	...	Fe., 1926	0.07½
Lucky Jim	Spokane	*32½	*31½	*31½		
Lucky Tiger-Com	Kansas City	†7.70	†7.50	...	Je.7,.Je.20MX	0.07
Mammoth Mining	Salt Lake	†1 60	†1.35	...	De., 1926	0. 25
North Lily	Salt Lake	†7.80	†7.60	7.60		
Park Utah	New York	12	11⅛	11⅛	Je.15, Jl.2 Q	0.20
Plutus Mining	Salt Lake	†2.00	†1.65	...	Ap.10, Ap.16 Q	0.10
Rico-Argentine	Salt Lake	*45	*45	*45	June 15 Q	0.03
Silver King Coal	Salt Lake	12	12	12	Je.20, Jl.2 Q	0.25
Silversmith	Spokane	*10	*8½	*9½	Oct., 1926 Q	0.02
Strattons Mines	Spokane	*96½	*90	*95		
Sunshine M. Co	Spokane	1.40	1.35	1.38	June 20,	0.02
Tamarack-Custer	Spokane	*48½	*46½	*48½	Sept., 1924	0.25
Tintic Standard	Salt Lake	14	13⅜	13⅜	Je.18, Je.30 QX	0.30
Utah-Apex	Boston	4	3⅞	3⅞	Jl.14, Au.1 1926	0.25
IRON						
Bethlehem Steel	New York	58⅜	54⅞	57⅛	Jl., 1924	1.25
Cleveland-Cliffs Iron	Cleveland	106	106	106	Jl.14, Jl.25. Q	1.00
Colorado Fuel & Iron	New York	68⅛	62⅜	64	Au.10, Au.25 Q	2.00
Gt. North'n Iron Ore	New York	22⅛	20⅛	21⅞	Ap. 9, Ap. 30 K	0.75
Inland Steel	New York	57	55	56½	My. 15, Je.1 Q	0.62½
Republic I. & S	New York	57⅛	54⅛	56	Au. 14, Se. 1 Q	1.00
Republic I. & S. pfd	New York	105⅞	105⅞	105⅞	Se. 15, Oc. 1 Q	1.75
Sloss-Sheffield S. & I	New York	...	...	111	Je.9, Je.20 Q	1.50
Sloss-Snef. S.&I. pfd	New York	...	...	115⅜	Je. 20, Jl. 2 Q	1.75
U. S. Steel	New York	145⅜	137⅛	144⅛	My.31, Je.29 Q	1.75
U. S. Steel, pfd	New York	141⅛	141	141⅜	Ap. 30, My. 29 Q	1.75
Virginia I. C. & C	New York	...	...	14⅛	Jan., 1924	1.50
Virginia I.C.&C. pfd	New York	...	...	52⅛	Je. 16, Jl. 2 SA	2.50
DIAMONDS, PLATINUM, ALUMINUM, VANADIUM, TIN						
De Beers Consol	New York	23⅛	23⅛	23⅛	July., 1927	1.45
So. Am. G. & P	N. Y. Curb	3	3	3		
Alum. Co. of Amer	N. Y. Curb	135	132	132		
Alum. Co. of Amer. pf	N. Y. Curb	108	107½	107½	Je. 15, Jl. 1 Q	1.50
Vanadium Corp	New York	76½	71⅞	75⅛	Au. 1, Au. 15 Q	0.75
Patino M. & E	New York	34½	30½	33⅛	April, 1928	4s.
ASBESTOS						
Asbestos Corp	Montreal	30⅛	29⅜	30	Jan., 1926	1.50
Asbestos Corp. pfd	Montreal	92	90	90	Jl. 30, Jl. 16 Q	1.75
SULPHUR						
Freeport Texas	New York	62⅛	55	61⅛	Jl.14,Au.1 QX	1.75
Texas Gulf	New York	71½	66⅛	70	Je.1, Je.15 Q	1.00
MINING, SMELTING, REFINING AND GENERAL						
Amer. Metal	New York	49⅜	47	49⅛	Au. 21, Se.1 Q	0.75
Amer. Metal, pfd. 6%	New York	...	...	111½	Au.15, Se.1 Q	1.50
Amer. Met. pfd. 7%	New York	...	...	125	My.15, Je.1	1.75
Amer. Sm. & Ref	New York	204⅜	188½	203¼	Jl 13, Au.1 Q	2.00
Amer. Sm. & Ref. pfd	New York	135½	133¾	135½	Au. 3, Se. 1 Q	1.75
Consol. M. & S	Montreal	251½	250	250½	Je.30, Jl.16 SAX	6.25
Newmont Mining	N. Y. Curb	162⅜	154	162½	Je.30, Jl.16 Q	1.00
U. S. Sm. R. & M	New York	47¼	46⅛	47⅛	Jl. 5, Jl. 14 Q	0.87½
U.S. Sm. R.&M. pfd	New York	53½	53	53⅛	Jl. 5, Jl 14 Q	0.87½

*Cents per share. †Bid or asked. Q, Quarterly. A, Annual. SA, Semi-annually. M, Monthly. FW, four weeks. K, irregular. I, Initial. X, Includes extra. The first date given is that of the closing of the books; the second that of the payment of the dividend.

Boston quotations courtesy Boston Stock Exchange; Toronto quotations those of the Standard Stock Exchange of Toronto, by courtesy of Arthur E. Moysey & Co.; Spokane, Pohlman Investment Co.; Salt Lake, J. A. Hogle & Co.; Colorado Springs, Colo., Henry Sachs.

LONDON QUOTATIONS—WEEK ENDED July 18, 1928

Name	High	Low	Last	Date	Amount	Last Div.
Alaska Mexican ($5)	35 —	35/—	35/—			
Alaska Treadwell ($25)	120/—	120/—	120/—	Nov., 1926	4 (d)	
Aramayo Mines (25 frs.)	61/3	56/3	57/6	May, 1928	5 p.c. (†)	
Burma Corpn. (10 rupees)	14/3	13/9	14/—	Aug., 1928	6 annas*	
Bwana M'Kubwa (5s)	5/7½	5/1½	5 4½			
Camp Bird (2s)	4/—	3/7½	3/9	April, 1928	16½ p.c.	
El Oro (£1)	4/4½	4/—	4/4½	Nov., 1924	2½ p.c.*	
Frontino & Bolivia (£1)	11/3	10/6	10/6	Jan., 1928	5 p.c.	
Mexican Corpn. (£1)	10/4½	9/6	9/6			
Mexico Mines of El Oro (£1)	19/9	17/6	17/6	Dec., 1926	3½ p.c.*	
Mond Nickel	176/3	163/1½	170/½	Aug., 1928	20 p.c.	
N'Changa Copper Mining	20/	16/9	19 —			
Oroville Dredging (£1)	3/9½	3/7½	3/9	Dec., 1923	3½ p.c.	
Rhodesian Congo Border (£1)	35/—	31/6	33/9			
St. John del Rey (£1)	12/3	11/6	11/6	April, 1928	7½ p.c.	
San Francisco Mines (10s)	27/6	26/9	27/3	July 1928	12 p.c.	
Santa Gertrudis (£1)	15/4½	14/10½	15/--	July 1928	7½ p.c.	
Selukwe (2s. 6d.)	11/—	10/—	10/9	April, 1917	6¼ p.c.	
S. Amer. Copper (2s.)	2/4½	2/—	2/3	Nov., 1917	75p.c	
Tanganyika (£1)	56/3	55/—	55/7½	Aug., 1927	7½p.c.	
Union Miniere de Haut-Katanga (Brussels)	10,785	10,575	10,785	July, 1928	182.60 (‡)	

*Free of British income tax. †Swiss francs and plus 15 p. c. bonus. ‡Belgian frs. and free of taxation. §U. S. Dollars.